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THESIS

MEASURING THE EFFECT OF THE DEFENSE ACQUISITION WORKFORCE IMPROVEMENT ACT

by

Joseph Kevin Pope

June, 1997

Thesis Advisor: Walter E. Owen

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This study identifies the objectives of DAWIA. Using the Policy Effectiveness Model, the study develops and proposes metrics for DAWIA objectives in an effort to measure the implementation and effectiveness of this important and far-reaching acquisition reform legislation.

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MEASURING THE EFFECT OF THE DEFENSE ACQUISITION WORKFORCE IMPROVEMENT ACT

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Submitted in partial fulfillment
of the requirements for the degree of

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from the

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ABSTRACT

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I. INTRODUCTION

A. AREA OF RESEARCH

The purpose of this research is to explore how the effects of the Defense Acquisition Workforce Improvement Act (DAWIA) of 1990 can be measured.

B. BACKGROUND

The Defense Acquisition Workforce Improvement Act is the public law enacted in 1990 that prescribes how the acquisition workforce will be managed. The objective of DAWIA is to develop a dedicated pool of highly qualified military and civilian acquisition specialists to fill designated critical acquisition positions in order to create a more efficient and effective procurement system for the Government. DAWIA covers acquisition corps membership requirements, contracting officer requirements, PM qualification standards, requirements for assignment to critical acquisition positions, and waiver requirements.

To date, a great deal of time, effort, and money have been spent on implementing the requirements of DAWIA. However, there is little information available indicating how the acquisition process has benefitted as a result of that time, effort, and money. This research explores ways to determine those benefits. Specifically it looks at ways to determine DAWIA's impact on the acquisition process and introduces metrics as measures of effectiveness.

Measurement often leads to controversy and argument.

What are appropriate metrics for the process and the product? How should the data be collected and used? Is it fair to use measurements to compare people, processes, or products? These questions and dozens of others always surface when an attempt is made to measure something that has not been measured in the past. Such is the case with measuring the effect of DAWIA.

C. RESEARCH QUESTIONS

The primary research question is:

How can the effectiveness of DAWIA be measured?

Subsidiary research questions are:

1. What are the objectives of DAWIA?
2. What is a metric and what types of metrics are suitable for acquisition?
3. What metrics are currently being used to measure the effects of DAWIA on the acquisition process?
4. Are these appropriate metrics?
5. Are there standardized metrics for acquisition reform initiatives? If not, should standards be established?

D. SCOPE

This thesis describes DAWIA, a history of acquisition reform and the events that led to DAWIA; discusses the use of metrics to measure people, processes, and products; determines and discusses the metrics used to measure the effect of DAWIA; and provides recommendations.

E. METHODOLOGY

The first objective of this research is to provide an overview of acquisition reform, DAWIA, and metrics. This is accomplished through a literature review of sources including:

- References, publications and electronic media available at the Naval Postgraduate School Library
- Internet websites and homepages (DoD, commercial, and academic)
- Published academic research papers
- Unclassified Department of Defense publications

The second objective is to analyze DAWIA and determine suitable metrics for measuring the effectiveness of DAWIA. The analysis will be accomplished using the Policy Effectiveness Model [Ref. 1: p. 330]. The primary sources of this information are DoD reports, acquisition literature, and interviews with faculty and officials from Defense Acquisition University, Defense Systems Management College, and the Naval Postgraduate School; acquisition reform office personnel; and acquisition workforce personnel.

F. ORGANIZATION

Chapter II (Background) provides a history of acquisition reform and describes the events that led to enactment of DAWIA. It also provides a description of DAWIA requirements and objectives.

Chapter III (Metrics) introduces metrics, providing definition, purpose, and benefits. The chapter describes a

methodology for establishing metrics in an organization. The chapter then examines the use of metrics in various fields--software, education, and DoD acquisition reform.

Chapter IV (Analysis of DAWIA Metrics) provides an analysis of the metrics used for DAWIA and an analysis of DAWIA objectives. The chapter then tailors metrics to DAWIA requirements.

Chapter V (Summary, Conclusions, and Recommendations) summarizes the findings of the research, answers the research questions, and presents recommendations for further research and study.

G. BENEFITS OF STUDY

This study explores ways to determine the effectiveness of DAWIA through the use of metrics. This information provides valuable feedback to acquisition leaders that will enable them to develop measures and techniques for determining the effectiveness of acquisition reform initiatives. The use of measures allows acquisition leaders to assess DAWIA and possibly other reform initiatives in order to direct future efforts and give them opportunity to provide maximum benefit to the acquisition process.

II. BACKGROUND

A. INTRODUCTION

This chapter provides a history of acquisition reform and describes the events that led to the enactment of DAWIA. It also provides a description of DAWIA requirements and closes with a chapter summary.

B. HISTORY OF ACQUISITION REFORM

The federal acquisition system is undoubtedly one of the most thoroughly developed, documented, examined, and scrutinized, acquisition systems in existence [Ref. 2: p. 2]. The federal acquisition system has long suffered from negative perceptions. Innumerable articles and reports have been generated discussing the ineffectiveness of our acquisition system. Reports of the huge cost overruns involving the purchases of weapons, vehicles, hammers, etc. have filled the newspapers for decades.

As a result, there have been numerous attempts to improve the acquisition process through various reform initiatives. These reform initiatives began with the large procurement of weapons in World War II and are likely to continue as long as the government remains in the procurement business.

Weapons production in the United States has been big business since World War II. President Roosevelt, recognizing the need to mobilize the nation's industrial might, sought to centralize weapons procurement when he appointed Donald Nelson

as the War Production board Chairman. Nelson's mission was to oversee the military department's development and purchase of war equipment. Nelson, however, failed to carry through with Roosevelt's intent of centralizing procurement. He elected to defer to the departments, believing his decisions would undermine their process with unnecessary civilian oversight. Nelson's hands-off approach likely resulted from his predecessor, Bernard Baruch, who upon being appointed during World War I by President Wilson, was directed to exercise minimal interference.[Ref. 1]

The current acquisition management system began to develop in the Eisenhower administration. After World War II, there was rapid development of technology and a tremendous increase of worldwide American national security commitments. As a result, traditional roles of the services were split, creating interservice rivalry over weapon system development responsibility. President Eisenhower's answer to interservice rivalry and the resulting competition for resources was the creation of a centralized civilian authority in the relatively new Department of Defense.[Ref. 3: p. 2]

Eisenhower's proposal sought to establish a single uniformed service and to restructure the component branches along functional lines. However, because it ran contrary to the prerogatives of the uniformed services and perhaps Congress, this proposal was not adopted.[Ref. 3: p. 2]

Afterwards, Eisenhower's 1958 Defense Reorganization Act

realigned the U.S. defense structure, but unfortunately separated the administrative functions from the responsibility structure. This separation further complicated an already complex bureaucracy.[Ref. 3: p. 3]

During this era, contracting was dominated by cost-plus contracts in an effort to push technology forward rapidly and gain on the Soviets. However, in the 1960's the use of cost-plus contracts fell into disrepute as huge overruns occurred.

In 1961, Secretary of Defense (SECDEF) Robert McNamara sought to reform the acquisition process by instituting a business school approach to analyzing the needs of the nation's defense. McNamara wanted to incorporate more control into the acquisition process and he wanted the process to provide all of the information leaders needed in order to make decisions. He brought in Charles Hitch from the RAND Corporation to develop a systematic process for establishing requirements and incorporating them into a five-year budget. Hitch developed this process which later became known as the Planning, Programming, and Budgeting System (PPBS).[Ref. 3: p. 3]

McNamara's attempts to improve poor management through innovations in program planning, source selection, contracting, and program management failed to achieve expected results. His Total Package Procurement (TPP), essentially a fixed-price contract for Research and Development (R&D) and initial procurement, failed to achieve expected results. TPP

programs such as the C-5A, F-111A, and the F-14 failed to constrain cost, eventually had to be rewritten, and brought unfavorable nationwide attention.[Ref. 3: p. 4] As a result, fixed-price contracts fell into disuse on major systems until the 1980s.

During the Nixon and Ford administrations, Secretary of Defense Melvin Laird returned some of the services' autonomy, but retained some central control through a new senior level board called the Defense Systems Advisory Review Council (DSARC). The DSARC and the Cost Analysis Improvement Group (CAIG) provided the SECDEF more oversight over weapons acquisitions. Other attempts at improvements were short-lived or they were implemented superficially and for the most part were considered unsuccessful.[Ref. 3: p. 4]

The cycle of change continued with the next administration when Harold Brown, SECDEF in the Carter administration, sought to regain some of the authority in weapons acquisition relinquished previously. He issued a requirement for the services to comply with Circular A-109, an directive published by the Office of Federal Procurement Policy in 1976. Circular A-109 required the services to prepare a mission area analysis and document their weapons need in a mission needs statement.[Ref. 3: p. 4]

Change in the acquisition process continued with the next administration. In 1981, Caspar Weinberger, the SECDEF in the Reagan administration, implemented a change that reversed the

trend towards centralization. Weinberger gave more authority to subordinate line executives, especially program managers, to execute OSD policy.[Ref. 3: p. 4]

Twenty years after McNamara, the acquisition process was more structured and complex. In 1981, Frank Carlucci, Weinberger's Deputy Secretary of Defense, directed the services to implement 32 initiatives to reform the acquisition process. These initiatives aimed to streamline the acquisition process, reprogram costs, and shorten acquisition time. The underlying principle of the Carlucci initiatives was that over-regulation undermined efficiency. The services started many of his initiatives, but success was short-lived due to three factors; 1) a Congress reluctant to relinquish some of its purse-string powers, 2) services reluctant to change some of their practices, and 3) Carlucci's departure due to a new administration.[Ref. 3: p. 4]

Until the mid-eighties most reform recommendations addressed DoD's acquisition organization or process. In 1986, Reagan's Presidential Blue Ribbon Panel on Defense Management, also known as the Packard Commission, continued with this trend. Procurement spending doubled between 1980 and 1985, resulting in increased attention on defense acquisition and further examination of the process. The Commission, after examining the process, concluded that the defense acquisition process was not being operated and managed effectively, and was negatively affecting cost and efficiency of

procurement.[Ref. 3: p. 5]

As a result of the Commission's findings, Congress passed the DoD Reorganization Act of 1986. Although it recommended sweeping changes, some requiring Congressional action, the act failed to implement major recommendations. Consequently, President Bush directed a 1989 study. This study, called the Defense Management Review, led to extensive changes to the DoD acquisition organization. It streamlined the acquisition chain-of-command from the Defense Acquisition Executive through a newly created Service Acquisition Executive (SAE). The chain-of-command continued from the SAE to the Program Executive Officer (PEO) and to the program manager (PM).[Ref. 3: p. 5]

Through the years in addition to executive level scrutiny, Congress has taken an increased degree of interest in DoD acquisition efforts. Especially since 1970, Congress has accelerated legislation, enacting implementing regulations that further adds to the government bureaucracy and further complicates the acquisition process.[Ref. 3: p. 6]

For example, a goal of Congress in the 1970s and 1980s was to implement full and open competition in defense acquisition. Several laws within the last two decades underscore the importance of achieving that goal. These actions include: The 1978 Acquisition and Distribution of Commercial Products Program, the 1984 Competition in Contracting Act, and the 1989 Congressional Direction to

Streamline Regulations Governing Commercial Products.[Ref. 4: p. 20]

Congressional involvement continued as a result of the Ill Winds procurement scandal in the 1980s. The chairmen of the Armed Services Committees joined three former defense secretaries and industry executives to review the DoD acquisition system and concluded little improvement had been made over the years. The major product of their study was the introduction of several bills that all proposed centralizing acquisition through the establishment of an integrated acquisition system that would oversee procurement of all the services.[Ref. 3: p. 7]

One of the proposed bills was the creation of an acquisition corps in 1990. Representative Nicholas Mavroules (D, Massachusetts), Chairman of the House Armed Services Investigation Subcommittee, introduced the bill that was ultimately passed as the Defense Acquisition Workforce Improvement Act (DAWIA). This bill, the object of this study, directed DoD to create a professional acquisition corps in each of the services.[Ref. 3: p. 7]

The history of acquisition reform reveals many attempts to improve the process. Improvement efforts have been marked by hearings, executive commissions, legislative commissions, boards, and interagency task reviews [Ref. 2: p. 2]. Many of these efforts often reversed previous changes to the process, resulting in a cyclical affect of change to the system. DAWIA

is a law that resulted from these efforts to improve the acquisition system. Next, we will look further into the events that led to DAWIA.

C. EVENTS LEADING TO DAWIA

1. The Packard Commission

The Packard Commission study is likely one of the most influential events that brought about the creation of DAWIA. The major task of the Commission was to evaluate the defense acquisition system, to determine how it might be improved, and to recommend changes that could lead to the acquisition of military equipment with equal or greater performance but at lower cost and with less delay.[Ref. 5: p. 4]

The Packard Commission concluded in their report that the defense acquisition system has basic problems that must be corrected. The report states:

> These problems result from an increasingly bureaucratic and over regulated process. As a result, all too many of our weapon systems cost too much, take too long to develop, and by the time they are fielded, incorporate obsolete technology.[Ref. 5: p. 5]

The Commission discovered that the problems seldom result from fraud or dishonesty. The problems were symptomatic of other underlying problems affecting the entire acquisition system. These problems are [Ref. 5: p. 6]:

1) Goldplating - the inclusion of system features that are desired but not necessary, resulting in costs that far exceed the system's real value. Goldplating results from

"user pull" and "technology push." User pull occurs when users specify military needs. Frequently, these users have no knowledge of the cost and schedule implications for satisfying those needs and thus lack any incentive to compromise. Technology push occurs when government or industry conceive of new or advanced technologies and persuade users to state requirements that make use of the new technology.

2) The environment - The highly competitive environment for government funds forces marketing of programs in order to obtain and hold on to funds. When a program finally receives budget approval, the environment has frequently forced programs to overstate requirements and understate costs.

3) Source Selection - The environment in which program competition takes place forces bidders to comply and make improvements within program specifications, not to develop modifications that deviate from these specifications. This results in less emphasis on performance and more on optimizing costs. Frequently the bid goes to the contractor with the most optimistic bid. Optimistic bids result in understated costs or underbidding. The underbidding contractor will try to recover by negotiating performance tradeoffs or submitting engineering change orders.

4) PM priorities - Instead of managing the program, the PM spends a great deal of time answering to an army of special interest advocates. Each of these advocates can demand that the program manager take or refrain from taking some action,

but none of them has any responsibility for the ultimate cost, schedule, or performance of the program. These special interests include DoD agencies, contractors, Congress, and a host of special interest groups. All of these pressures force the program manager to spend most of his time briefing his program as opposed to managing it. The report states:

The above problems result in an extremely long acquisition cycle - typically ten to fifteen years for major programs. Long acquisition cycles lead to further problems [Ref. 5: p. 8]:

- High development costs. The longer it takes to develop and field a system, the more expensive the process.

- Obsolete technology. By the time the system is fielded, its technology is possibly obsolete.

- Goldplating. In anticipation of long lead times for fielding the system, users may be inclined to overstate the requirements and the threat in order to counter obsolescence.

None of the above problems directly point to the acquisition workforce and the need to improve the quality of the acquisition workforce. They point to factors external to the workforce - the process, user, PM demands, etc. To determine the link with the workforce, we must look further into the Packard Commission Report to a study the report cited. This study was undertaken by the Defense Science Board (DSB)[Ref. 5: p. 11]. The DSB compared typical DoD development programs with successful programs from private

industry and discovered six underlying features common to these successful commercial programs.

One feature was the small, high quality staffs of these commercial programs.

> Generally, commercial program management staffs are much smaller than in typical defense programs, but personnel are hand-selected by the program manager and are of very high quality. Program staffs spend their time managing the program, not selling it or defending it.[Ref. 5: p. 12]

The above observation by the DSB resulted in the Packard Commission's seventh recommendation: Enhance the Quality of Acquisition Personnel. It states:

> DoD must be able to attract and retain the caliber of people necessary for a quality acquisition program. Significant improvements should be made in the senior-level appointment system. The Secretary of Defense should have increased authority to establish flexible personnel management policies necessary to improve defense acquisition. An alternate personnel management system should be established to include senior acquisition personnel and contracting officers as well as scientists and engineers. Federal regulations should establish business-related education and experience criteria for civilian contracting personnel, which will provide a basis for the professionalization of their career paths. Federal law should permit expanded opportunities for the education and training of all civilian acquisition personnel [Ref. 5: p. 27].

With this recommendation, the Packard Commission linked the performance of the acquisition system to management of acquisition personnel. They determined that progress in the performance of the acquisition system demands improvement in the management of acquisition personnel.

The report compared the acquisition workforce with its

civilian counterparts and concluded, "this work force is undertrained, underpaid, and inexperienced."[Ref. 5: p. 28] The report stressed the importance of enhancing the quality of the defense acquisition work force--both by attracting qualified new personnel and by improving the training and motivation of current personnel.

In summary, the Packard Commission found many problems with the acquisition process. None of these problems seemed to directly result from the quality of the acquisition workforce. However, as a result of the DSB study that compared the acquisition workforce to its industry counterparts, the Packard Commission recommended improving the quality of the acquisition workforce.

2. Congressional Hearings

The House Armed Services Committee, Investigations Subcommittee, held hearings regarding the acquisition workforce on 28 March and 24 April 1990. These hearings ultimately led to the passing of DAWIA. Witnesses at these hearings were leaders in DOD acquisition, academia, and industry. They included current and former Under Secretaries of Defense, the CEO of Martin-Marietta, the chairman of the President's Blue Ribbon Commission on Defense Management, and the Commandant of the Defense Systems Management College.

The subcommittee conducted hearings on proposals for creating a "rationally and logically structured acquisition workforce which would serve as the foundation for a high

quality professionalized acquisition corps of senior executives."[Ref. 6: p. 1] The chairman of the Investigations Subcommittee, Hon. Nicholas Mavroules stated:

> For many years, now, we have enacted all sorts of legislation dubbed `Acquisition Reform'. We have changed the process. We have changed the procedures. We have changed many of the roles. But we have not yet addressed the most important element in the equation: people.
>
> For the past year-and-a-half, the staff has been collecting data on the quarter million people who spend about $140 billion a year in taxpayer money. Here are a few things we have learned. The fragmented training system requires 12 courses on contracting, but none for systems engineering or logistics, although they are key cost drivers. Less than a third of those assigned as program managers of major Navy systems have ever attended a course on program management.
>
> ...we need to pay more attention to the people in the acquisition field. We need to train them better. We need to pay more attention to their career paths. We need to prepare them as professionals and then we need to respect them as professionals.[Ref. 6: p. 1]

It was clear from these hearings that the consensus among committee members and witnesses was that the intent of the subcommittee proposals was fully supported. Various approaches were presented and witnesses voiced some concerns over details of the proposed legislation, but on the whole all attendees agreed with the proposal to develop and manage a highly trained, motivated, and professional acquisition workforce.

D. DAWIA

The Defense Acquisition Workforce Improvement Act, Public Law 101-510, Title XII was passed on November 5, 1990. The law directs the following [Ref. 7: p. 1638]:

- Revises policies and procedures for the recruitment, training, and career development of military and civilian defense acquisition personnel.
- Requires DoD to establish acquisition corps for each military department and for other defense agencies.
- Directs DoD to establish policies and procedures for acquisition personnel education and training programs, including intern, cooperative education, and scholarship programs.
- Establishes a defense acquisition university.
- Authorizes special pay for acquisition officers in certain critical positions, and repayment of student loans to facilitate recruitment or retention of acquisition personnel.

DAWIA comprises five subchapters. These subchapters are summarized below.

1. Subchapter I, General Authorities and Responsibilities

Outlines roles, authorities, and responsibilities for the Secretary of Defense, Under Secretary of Defense for Acquisition, the Director of Acquisition Education, Training, and Career Development, Service Acquisition Executives, and the Directors of Acquisition Career Management in the military departments. This subchapter directs the Secretary of each military department, acting through the service acquisition executive, to establish an acquisition career program board to advise the service acquisition executive in managing the accession, training, education, and career development of military and civilian personnel in the acquisition workforce and in selecting individuals for an Acquisition Corps.[Ref. 7: p. 1638]

2. Subchapter II, Defense Acquisition Positions

Directs the Secretary of Defense to designate those

positions in the Department of Defense that are acquisition positions. The acquisition positions must include the following areas [Ref. 7: p. 1640]:

- Program management
- Systems planning, research, development, engineering, and testing
- Procurement, including contracting
- Industrial property management
- Logistics
- Quality control and assurance
- Manufacturing and production
- Business, cost estimating, financial management, and auditing
- Education, training, and career development,
- Construction
- Joint development and production with other government agencies and foreign countries

Section 1722 directs the Secretary of Defense, acting through the DAE, to:

> ...ensure that appropriate career paths for civilian and military personnel who wish to pursue careers in acquisition are identified in terms of the education, training, experience, and assignments necessary for career progression of civilians and members of the armed forces to the most senior acquisition positions. The Secretary shall make available published information on such career paths.[Ref. 7: p. 1641]

This section further directs the Secretary to limit preference for military personnel while taking actions to ensure that civilians are given maximum opportunity to qualify for senior acquisition positions through selection of the best qualified individuals. It also directs the Secretary to increase the proportion of civilians serving in critical acquisition positions.[Ref. 7: p. 1641]

This law directs the Secretary of Defense to establish

education, training, and experience requirements for each acquisition position. Section 1724 specifically outlines qualification requirements for contracting positions.[Ref. 7: p. 1642]

3. Subchapter III, Acquisition Corps

Directs the Secretary of Defense to establish an Acquisition Corps for each of the military departments. The SECDEF must ensure that the officers within the Acquisition Corps are promoted at the same rate as all line officers. Selection and eligibility criteria must be established regarding education and experience.[Ref. 7: p. 1644]

Acquisition Corps qualification criteria are specified in this subchapter. For example, it requires corps members to have a baccalaureate degree at an accredited educational institution and at least 24 semester credit hours (or the equivalent) of study from an accredited institution of higher education from among the following disciplines: accounting, business finance, law, contracts, purchasing, economics, industrial management, marketing, quantitative methods, and organization and management or 24 semester credit hours (or the equivalent) from an accredited institution of higher education in the person's career field and 12 semester credit hours from such an institution from among the above disciplines.[Ref. 7: p. 1645]

According to this subchapter, critical acquisition positions can be filled only by members of the Acquisition

Corps. The SECDEF must designate the acquisition positions that are critical acquisition positions. The positions must include acquisition positions requiring civilian grades of GS-14 or above, Senior Executive Service, military members in the grade of O-5 or above, program executive officer positions, program managers, and "any other acquisition position of significant responsibility . . . "[Ref. 7: p. 1643]

Subchapter III also specifies assignment periods for program managers, stating:

> ...a program manager and a deputy program manager of a major defense acquisition program must be assigned to the position at least until completion of the major milestone that occurs closest in time to the date on which the person has served in the position for four years . . . [Ref. 7: p. 1647]

Subchapter III further specifies experience and education requirements for program managers, deputy program managers, program executive officers, general officers and civilian equivalent positions, and senior contracting officials. For example, prior to being assigned to a program manager position, a person must have completed the program management course at Defense Systems Management College or comparable program (with SECDEF approval), and, for major programs, have at least eight years of experience in acquisition, at least two years of which were performed in a program office or similar organization.[Ref. 7: p. 1649]

4. Subchapter IV, Education and Training

Directs the SECDEF to establish policies and procedures

for establishing and implementing education and training programs. Programs to be established include intern programs, cooperative education programs, scholarship programs, and others such as tuition reimbursement and student loan repayment. The SECDEF is also required to establish and maintain a defense acquisition university structure to educate the acquisition workforce and provide research and analysis of defense acquisition policy issues from an academic perspective.[Ref. 7: p. 1651]

5. Subchapter V, General Management Provisions

Prescribes general management requirements and authorities. The chapter specifically directs the military departments and Defense Agencies to establish a management information system capable of providing standardized information to the Secretary on persons serving in acquisition positions.[Ref. 7: p. 1653]

With the passing of DAWIA, we have a law that prescribes the management policies for the acquisition workforce. This law outlines qualification requirements, assignment policies, career progression, and overall policies and structure for managing the acquisition workforce.

E. CHAPTER SUMMARY

Throughout U.S. history, the Defense acquisition process has been subjected to a great deal of reform efforts, largely as a result of negative perceptions about its efficiency as an

acquisition system. These perceptions emanate from executive administrations, Congress, and the public. Numerous acquisition reform initiatives have tried to alleviate these perceptions. These reform initiatives have historically been cyclical and are largely implemented without provisions requiring the measurement of their intended effect on the acquisition process.

DAWIA is an example of such a reform initiative. DAWIA's objectives are primarily to improve the quality of the acquisition workforce and to improve the acquisition process. How do we determine whether these objectives are being achieved? Metrics could be the answer. The next chapter introduces metrics and explores their use.

III. METRICS

A. INTRODUCTION

This chapter introduces metrics, providing definition, purpose, and benefits. The chapter describes a methodology for establishing metrics in an organization. The chapter then presents metrics used in other fields (e.g. software, education)and presents metrics proposed within DoD for acquisition reform.

B. METRICS DEFINED

In most technical endeavors, measurement and metrics help us to understand the technical process that is used to develop a product. The process is measured in an effort to improve it.[Ref. 8: p. 43]

At first, it would appear that using measurement in processes is a highly desirable tool. After all, measurement enables us to quantify and therefore manage more effectively. But reality can be somewhat different. Choosing the appropriate measures can be quite difficult and the choice can invite a lot of argument and controversy. What are appropriate metrics for the process? Is it fair to use measurements to compare people, processes, or products? These questions and dozens of others always surface when an attempt is made to measure something that has not been measured in the past.[Ref. 8: p. 43]

Lord Kelvin once said:

> When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of a science.[Ref. 8: p. 45]

C. MEASURING IN ORGANIZATIONS

An organization is a system with three levels of performance--organization, process, and job/performer--that must be managed in order to get consistent, high-level organization output. We measure within an organization so that we can monitor, control, and improve system performance at all three levels. We measure in order to [Ref. 9: p. 141]:

- Specifically communicate performance expectations to subordinates
- Know what is going on in the organization
- Identify performance gaps that should be analyzed and eliminated
- Provide feedback that compares performance to a standard
- Identify performance that should be rewarded
- Effectively make and support decisions regarding resources, plans, policies, schedules, and structure
- Identify areas for improvement

Another metrics perspective was presented by the Process Action Team (PAT) for contract administration reform in February 1995. The PAT identifies metrics that simply record whether an event has happened or not (go/no-go metrics), metrics that determine the extent to which an action is taking place (activity metrics), and metrics that measure whether actions are achieving the desired results.[Ref. 10: p. 37]

Effective use of measures means not only establishing measures, but using them properly. Measures must be used to monitor the things in an organization that are linked to organization goals and objectives. The measurement system, in its totality, should contain related measures that are not counterproductive. Finally, the measurement data must be collected and used for the benefit of the organization through intelligent action.[Ref. 9: p. 142]

Rummler and Brache, in "Improving Performance" developed the following sequence for establishing measures in an organization [Ref. 9: p. 143]:

1. Identify the most significant outputs of the organization, process, or job.

2. Identify the "critical dimensions" of performance for each of these outputs. Critical dimensions of quality include accuracy, ease of use, novelty, reliability, ease of repair, and appearance. Critical dimensions should be derived from the needs of the internal and external customers who receive the outputs and from the financial needs of the business.

3. Develop the measures for each critical dimension. For example, if "ease of use" is a critical dimension of quality for a given output, one or more measures should answer this question: "What indicators will tell us if our customer finds our product or service (output) easy to use?"

D. MEASURING IN VARIOUS FIELDS

Metrics exist in many fields, and each field approaches the use of metrics in a unique way. The fields presented are software development and training/education. These fields were chosen because their products are difficult to measure and thus present similar metrics challenges to those facing acquisition reform and DAWIA. Each field has attempted to face the challenge of developing metrics that accurately and effectively measure what is actually intended to be measured.

1. Software

Software metrics refer to a broad range of measures for computer software. The primary focus of these measures is with productivity and quality--measures of output and fitness of use. The software community is interested in these types of metrics for planning and estimation purposes. They want to be able to determine productivity and quality on past projects and determine how the productivity and quality data can be extrapolated to the present.[Ref. 8: p. 45]

We measure software for many reasons: (1) to indicate the quality of the product; (2) to assess the productivity of the people who produce the product; (3) to assess the benefits derived from new methods and tools; (4) to form a baseline for estimation; (5) to help justify requests for new tools or additional training.[Ref. 8: p. 45]

The software community categorizes metrics in two ways:

direct and indirect measures. Direct measures are often physical, tangible measurements of a process or product such as cost, speed, size, and number of defects. Indirect measures, less straightforward measurements, include functionality, quality, complexity, efficiency, reliability, maintainability, and many other "abilities."[Ref. 8: p. 46]

Software metrics have been further categorized into the following: Productivity metrics focus on output, quality metrics provide an indication of conformance to a standard, technical metrics focus on the degree of complexity of a process or product, size-oriented metrics are used for direct measures, function-oriented metrics provide indirect measures, and human-oriented metrics collect information about the manner in which people develop products and the human perception about the effectiveness of tools and methods.[Ref. 8. p. 46]

2. Training and Education

Many organizations expend a great deal of resources on training and education programs for its employees, and the government is certainly no exception. These organizations assume or hope that these programs provide benefit to the organization with the ultimate objective of improving the performance of the organization.

Should the benefits of the training and education be based on assumptions and hope or should actions be taken to measure the effectiveness of the training and education? Most

organizations would prefer the latter for two reasons: 1) to justify the expenditure of resources on training and education;and 2) to improve the training and education programs in order to better meet the needs of the organization. This section explores ways to measure the effectiveness of training and education.

The key to measuring the effectiveness of training and education is to begin with the overall organization objectives. After overall organization objectives have been identified, the following steps should be taken [Ref. 11: p. 180]:

1) Identify employee performance behaviors that enable the organization to accomplish organization objectives.

2) Establish training to develop those performance behaviors.

3) Measure the resulting performance behavior against the desired performance behavior to determine the effect of the training.

4) Measure improvement in organization performance.

A training program should ultimately exist to change an old behavior to a new behavior. This new behavior should have some type of effect on the organization. If the new behavior is a desired behavior linked to organizational objectives, then the effect should be positive.[Ref. 11: p. 181]

However, linking training to organizational performance is likely to be very difficult. Organizational performance

improvements could result from many factors other than from training unless there is certainty that no other factors exist. Factors could include other areas such as process improvements, better products, organizational changes, etc. Therefore, a more effective evaluation of training programs would be limited to steps 1, 2, and 3 above. Odiorne states:

> If a course defines its intentions as changing specific old behavior to specific new behavior and this change actually occurs, the training must be considered successful. The evaluation of training is limited to assessing or measuring as accurately as possible how much of the desired (objective) behavior was actually attained and applied: first, in the class, and second, back on the job.
>
> If training actually changed behavior in the class then it must be considered a training success from the class standpoint and instruction technique standpoint. If it fails to convert back to the job, then the analysis of system support of that behavior may be at fault and not the training, but the prior planning and task analysis are probably at fault.[Ref. 11: p. 182]

Training and education programs consume a great deal of organization resources--time, people, and money--resources that could be used elsewhere to benefit the organization. Cost effectiveness studies aim to determine the benefit received from training and education programs compared to the resource cost for these programs.[Ref. 11: p. 183]

Cost effectiveness studies of training require that objectives for training be set and that these objectives have the following characteristics [Ref. 11: p. 190]:

1) They define the behavior change sought, stating what the present behavior is and its consequences and the desired

behavior and its consequences.

2) These must be stated in mixtures of words and numbers, which calls for quantifying certain key parts of the behavioral objectives in order that they might be used later as criteria for measuring contribution of the training effort.

However, measuring the effect of training and education can be quite difficult. Many aspects of human behavior do not lend themselves to quantification. The reliability of measures varies. Odiornes identifies the following measures in descending order of reliability [Ref. 11: p. 191]:

1) Hard, raw, real time data comprise the best kind of measurement. Dollars of expense cut, reduced performance time, and quantity of items produced are examples. This type of data is objective and can be easily verified. Unfortunately, it can be very difficult to directly tie this type of data to training.

2) Indices and percentages are used to denote change, including changed behavior. This measurement tool is less reliable than hard data, but nonetheless can be quite valuable. Batting coaches will watch the change in their students' batting average, slugging percentage, and runs batted in percentage to evaluate the effect of their teaching.

3) Position on a scale is a third type of measurement device where subjects use ratings to make assessments. On a scale of one to five, a supervisor may be asked to rate his employee's performance prior to training and after training.

4) Verbal descriptions, the least reliable and most subjective, are used when no other measure is possible.

Training evaluations frequently rely on student opinions. Surveys are gathered at the completion of the class or at the completion of each individual session. These surveys provide an assessment on the quality of instruction but provide no input on how the instruction impacts work performance.[Ref. 11: p. 192]

Opinions on training can also be obtained from third parties such as employee supervisors. Supervisors could get information from students about the class, either directly or indirectly, and make an assessment. This approach can be very disorganized, subjective, and as a result, unreliable.[Ref. 11: p. 193]

Opinions on training can be gathered from the trainer or training administrator. If the training is pleasing to these people, it may be considered successful. Clearly this approach can result in misleading assessments when the needs of the trainer or administrator take precedence over the needs of the student.[Ref. 11: p. 193]

There are additional, but less reliable ways to evaluate training and education programs. Participation measures are used to measure participation in terms of the number or percentage of personnel enrolled or the percentage of successful completions. If this type of evaluation equates enrollment or completion with success then the evaluation

fails. Participation is no indication of the success of a program. Comparison measures are used to compare training programs to training programs within similar organizations or compare to a standard quality program. This type of evaluation could lead to unfortunate conclusions because no two organizations are exactly alike and a standard quality program is based upon someone's subjective determination of what a quality program should be.[Ref. 12: p. 20]

There are many ways to measure and evaluate the success of training and education programs. Measures and evaluation based upon measurable criteria that relate to organization objectives are the most feasible and fruitful [Ref. 12: p. 21].

E. ACQUISITION REFORM METRICS

The focus on acquisition reform (AR) in recent years has resulted in increased efforts within DoD to develop metrics for assessing the efficiency gains within DoD acquisition. The Assistant Secretary of the Army for Research, Development, and Acquisition, Mr. Gilbert Decker, stated the following as one of his goals in his Acquisition Reform Strategic Plan for all Army acquisition organizations [Ref. 13]:

> Put metrics in place to measure progress. Elaborate reporting and feedback systems are counterproductive, but a few key, value-added metrics are necessary to focus efforts and determine progress. AR metrics should be developed to support the command strategy, be directly related to measurement of outcomes, and measure progress in the following high payoff areas:

1) Use metrics to measure the rapidity of technology insertion into fielded systems.
2) Measure increased use of performance specifications
3) Measure the reduction in acquisition cycle and procurement lead-times.
4) Measure total cost reductions.

1. DoD Acquisition Reform Metrics

DoD established the Acquisition Reform Benchmarking Group (ARBG) in 1996 to develop metrics for assessing the efficiency gains within DoD acquisition. These metrics are in the early stages of development. The ARBG states ". . . data presented for each metric is subject to refinement as the metrics are evaluated. Furthermore, metrics may be further developed or discarded in the future if deemed appropriate by the ARBG."[Ref. 14]

The ARBG has developed three levels of metrics; enterprise, subordinate, and program metrics [Ref. 15]. Enterprise metrics are used to assess efficiency gains of the total acquisition process. These metrics are further broken down into cost metrics, schedule metrics, training metrics, and performance metrics. Subordinate metrics are the next level of metrics. These metrics measure the subordinate tasks or elements that contribute to enterprise metrics. Program metrics are the lowest level metrics developed by the ARBG. These metrics measure factors relative to specific acquisition programs.

Following are descriptions and diagrams of enterprise, subordinate, and program metrics:

a. Enterprise Metrics

(1) Annual Rate Change. A cost metric intended to capture enhanced acquisition process control due to the implementation of Integrated Product Teams (IPTs) and Cost as an Independent Variable (CAIV) (Figure 1). The use of IPTs and CAIV is expected to diminish the historic fluctuation in program cost growth. This metric is calculated using Selected Acquisition Report (SAR) data from common DoD major defense acquisition programs across sequential years. [Ref. 16]

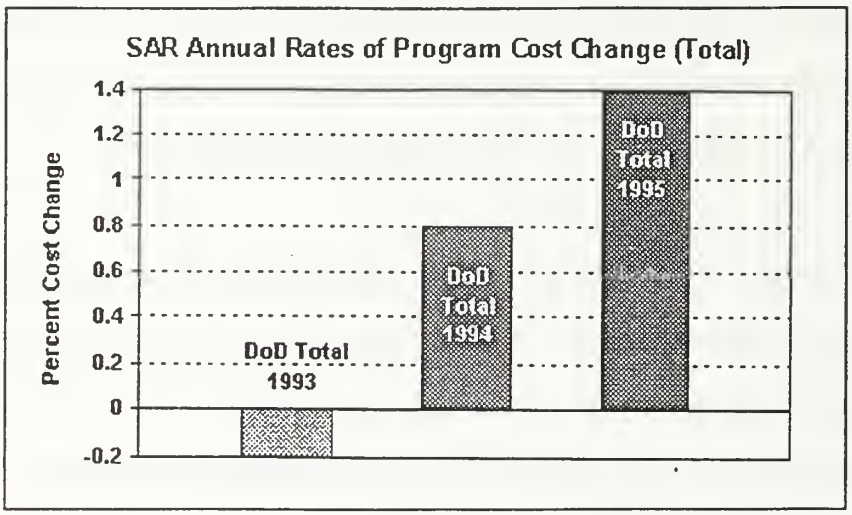

Figure 1. From Ref. [16]

(2) Purchasing Cost. A cost metric that presents the in-house costs incurred to purchase one dollar of goods and services, as a measure of in-house efficiencies (Figure 2). Simplified acquisition procedures and procurement process improvements are expected to decrease purchasing costs over time. The metric uses personnel data translated into purchasing cost by using salary and fringe benefits data from

the Service personnel offices, OSD, and DoD agencies. The purchasing dollar value is calculated based on procurement contract awards.[Ref. 17]

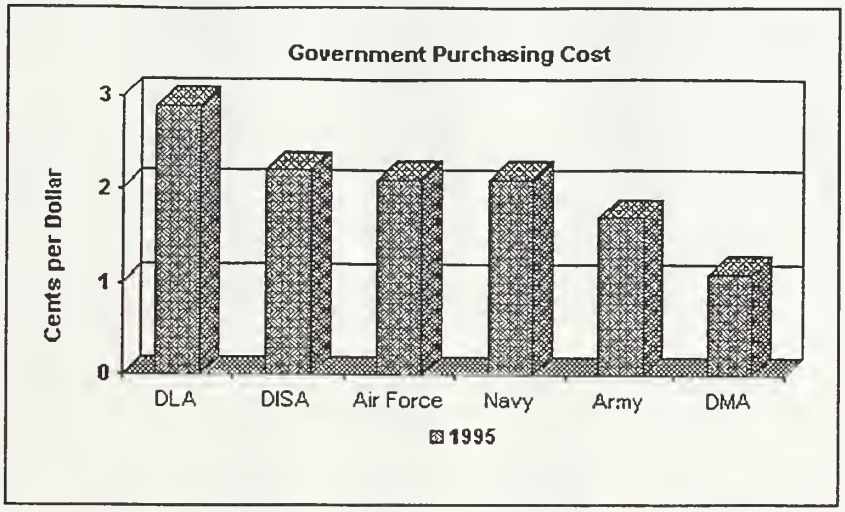

Figure 2. From Ref.[17]

(3) Cycle Time. A schedule metric that measures DoD progress in streamlining acquisition decision processes and procedures to reduce the amount of time between milestones from the concept definition through production and deployment of a weapon and/or information system for major defense acquisition programs (MDAP) (Figure 3).[Ref. 18]

(4) On Time Delivery. A schedule metric intended to capture the effects of IPTs and enhanced selection processes (such as past performance) (Figure 4). The metric presents the percent of contract line items which are on schedule in accordance with their contract terms. Data includes line items from major weapons systems to consumables,

but not ships or conventional ordnance.[Ref. 19]

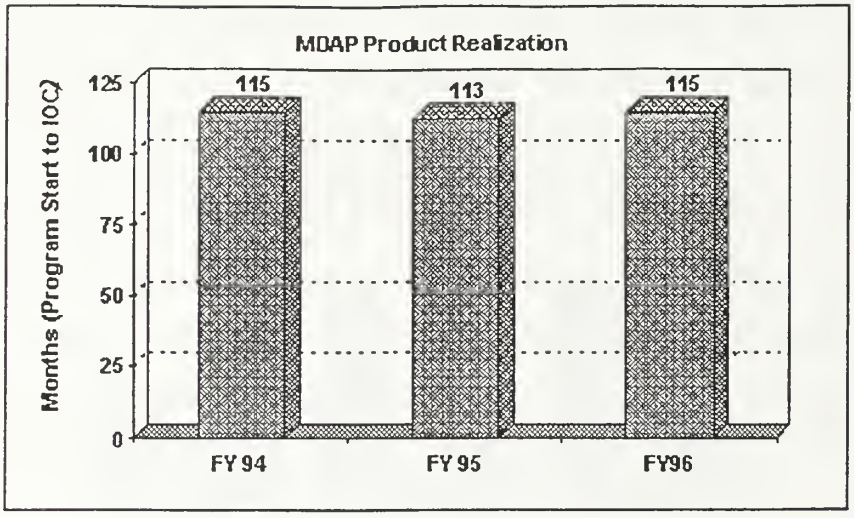

Figure 3. From Ref. [18]

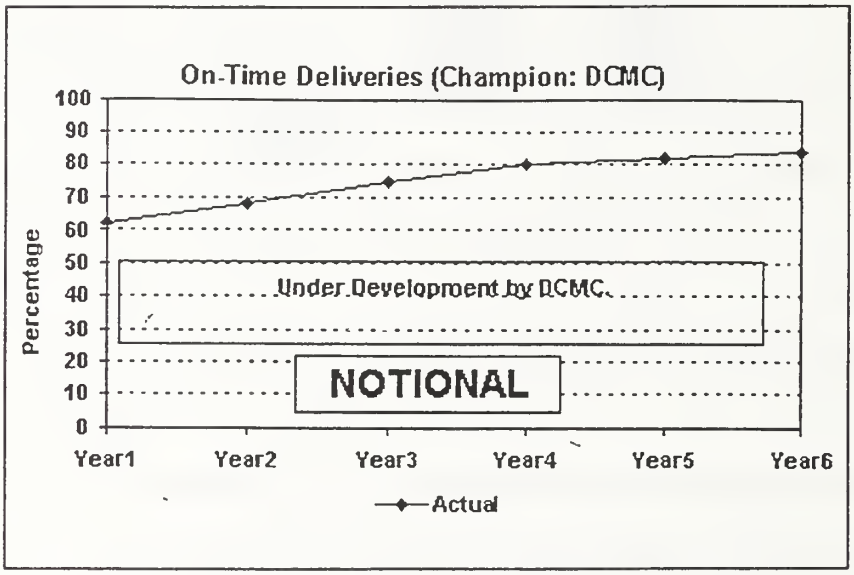

Figure 4. From Ref.[19]

(5) Workforce Development. A training metric that presents DoD's progress in continuing to develop the acquisition workforce through training (Figure 5). The metric measures the percentage of certified personnel across the number of coded positions requiring certification.[Ref. 20]

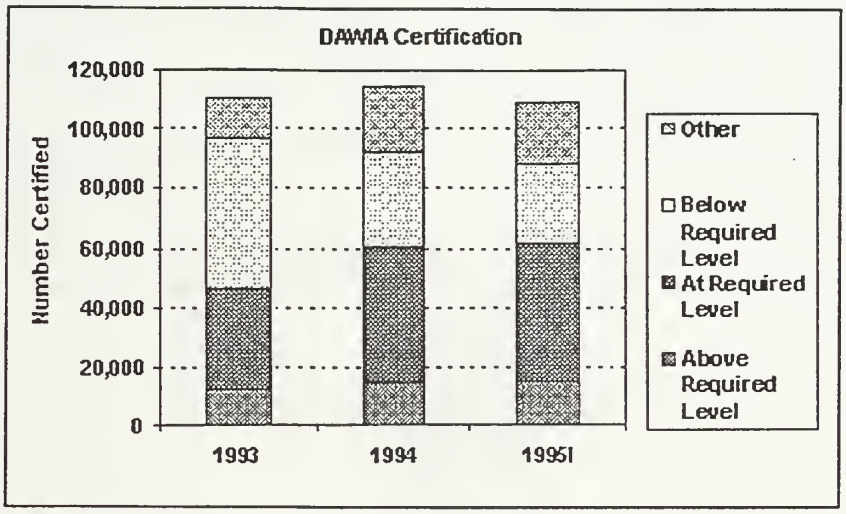

Figure 5. From Ref.[20]

(6) Quality. A performance metric intended to capture the effect of numerous DoD initiatives (MIL-STD reform, regulatory reform, IPTs) on the product and process quality of items procured by DoD, including quality of design, development and manufacture (Figure 6).[Ref. 21]

(7) MDAP Breach. A performance metric that captures efficiency gains due to IPTs associated with program breaches and resolution of those breaches (Figure 7). Over time, both the number of breaches and time to resolve them are expected to decline. The metric identifies the total number

of acquisition program baselines (APBs) as compared to the number of breaches resolved (cost, schedule, and performance) and the new breaches each month. [Ref. 22]

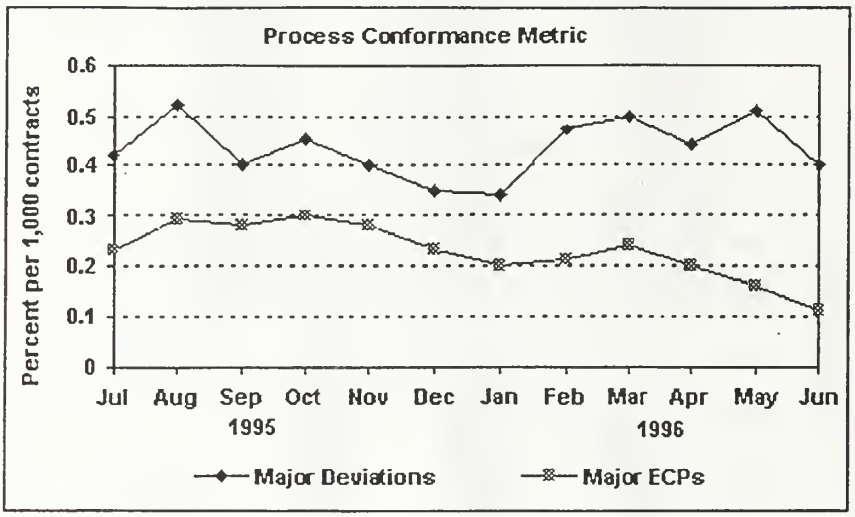

Figure 6. From Ref.[21]

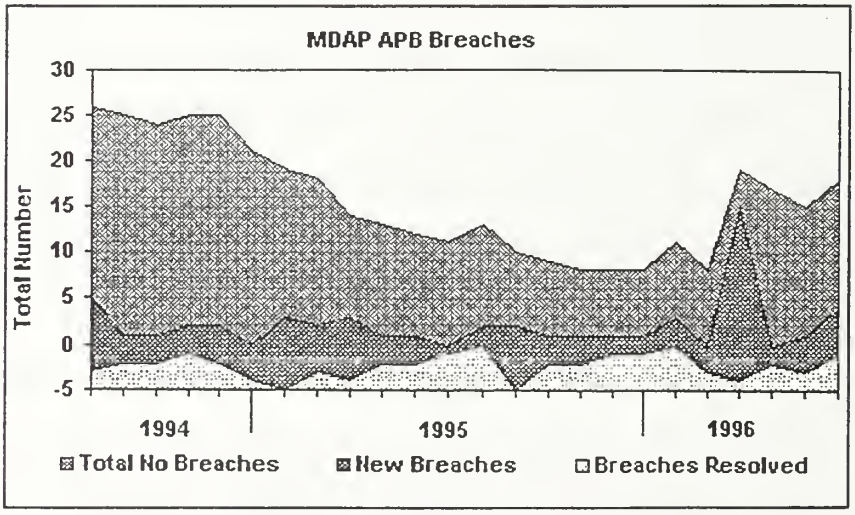

Figure 7. From Ref.[22]

b. Subordinate Metrics

(1) Cost Premiums. This metric is the observed regulatory cost premium paid for unique government requirements as estimated by DCAA based upon the 10 Reinvention Laboratories (Figure 8). The cost premium metric is a measurement of the acquisition reform cost avoidance and saving that can be achieved from joint contractor/government efforts to eliminate non-value added regulations.[Ref. 23]

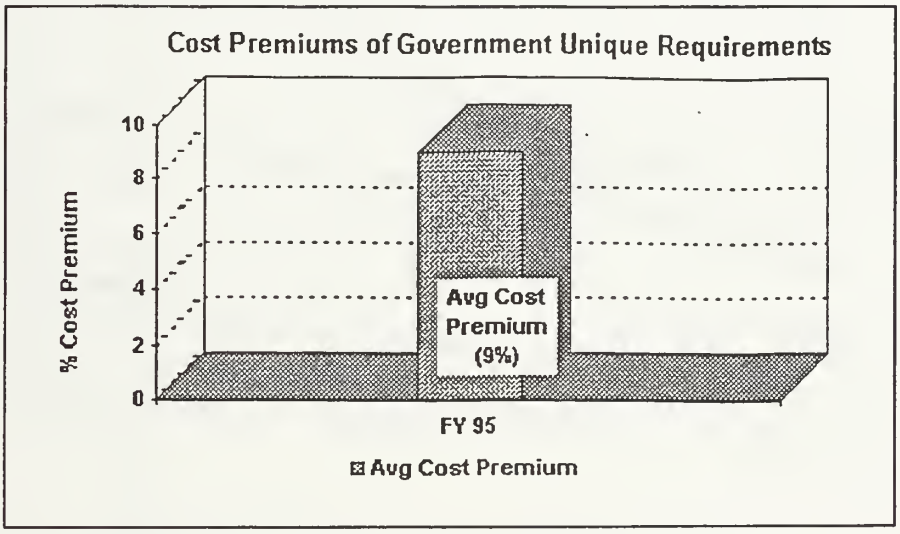

Figure 8. From Ref.[23]

(2) Consumable Item Price Index. A metric intended to capture the cost avoidances that can be achieved by adopting world class business processes for consumable items (Figure 9). The metric is a comparison of the Fisher Ideal Market Basket Index (five major DLS commodities) with the overall Defense Logistics Agency index of budgeted product costs for a sampling of more than 100,000 items.[Ref. 24]

(3) Conversion Price. Measures the cost avoidances associated with acquiring products and parts from reliable suppliers based upon performance (versus "how to") specifications (Figure 10). This metric represents the estimated cost avoidance from converting from military to commercial specifications on selected commodity purchases made by the Defense Logistics Agency.[Ref. 25]

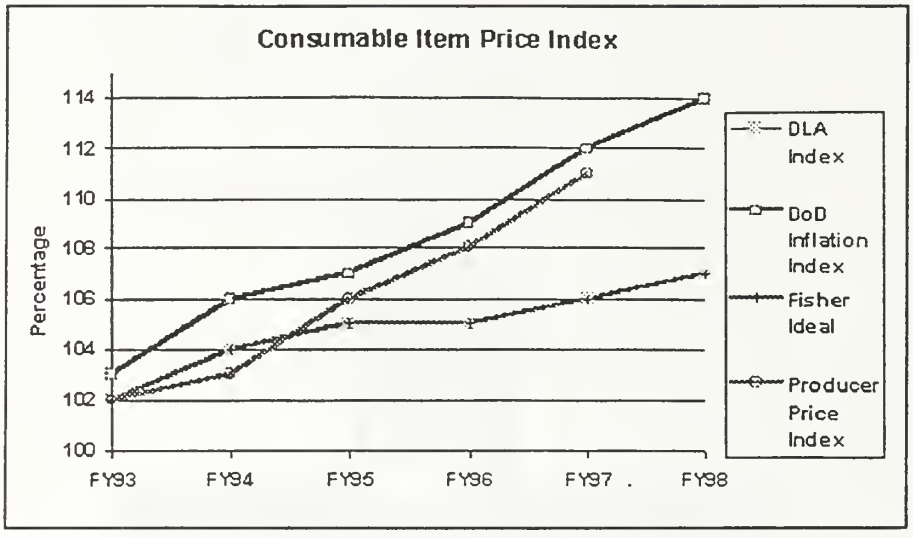

Figure 9. From Ref.[24]

(4) Commercial Content. An indicator of the degree of commercial material purchased by DoD (Figure 11). This metric indicates the dollar value of commercial items compared to total dollar value of all obligations for Acquisition Category (ACAT) I-III programs in DoD.[Ref. 26]

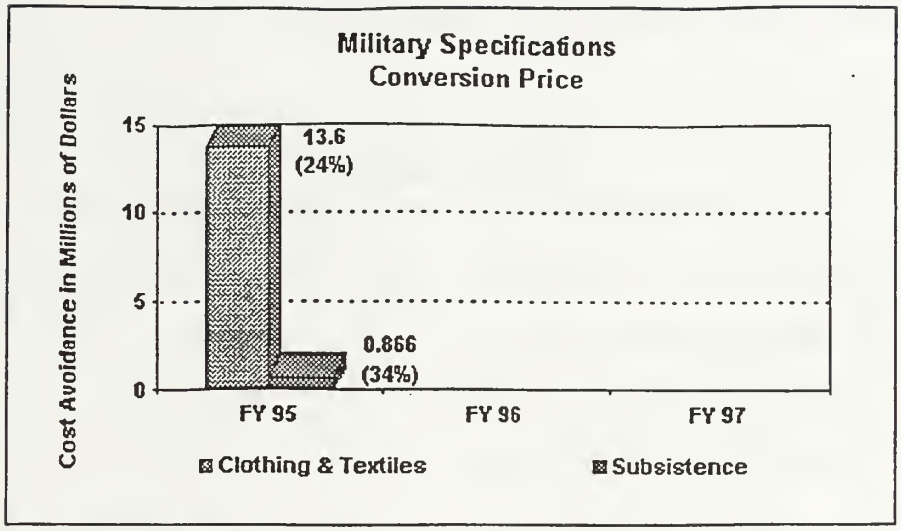

Figure 10. From Ref.[25]

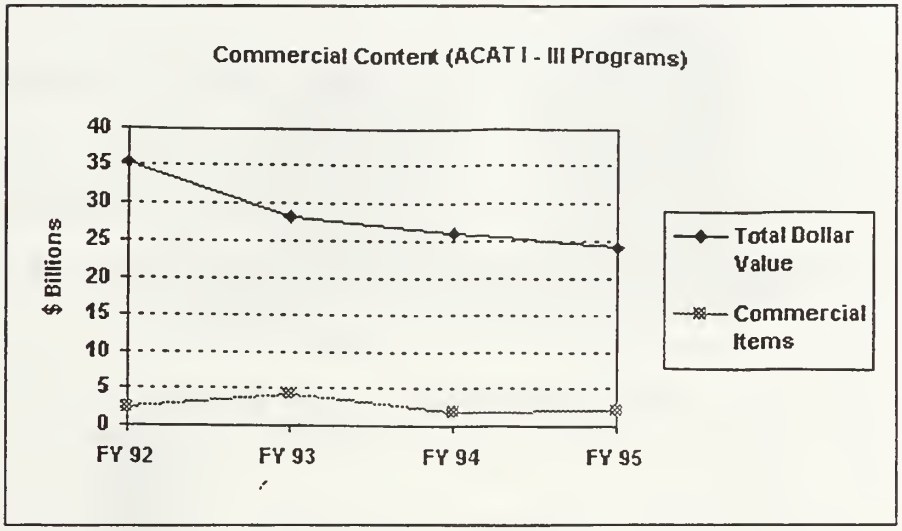

Figure 11. From Ref.[26]

(5) FACNET Transactions. Presents the number of FACNET transactions for all DoD organizations (Figure 12). This metric is a measure of the implementation of commercial purchasing practices and acquisition procedures such as

electronic data interchange.[Ref. 27]

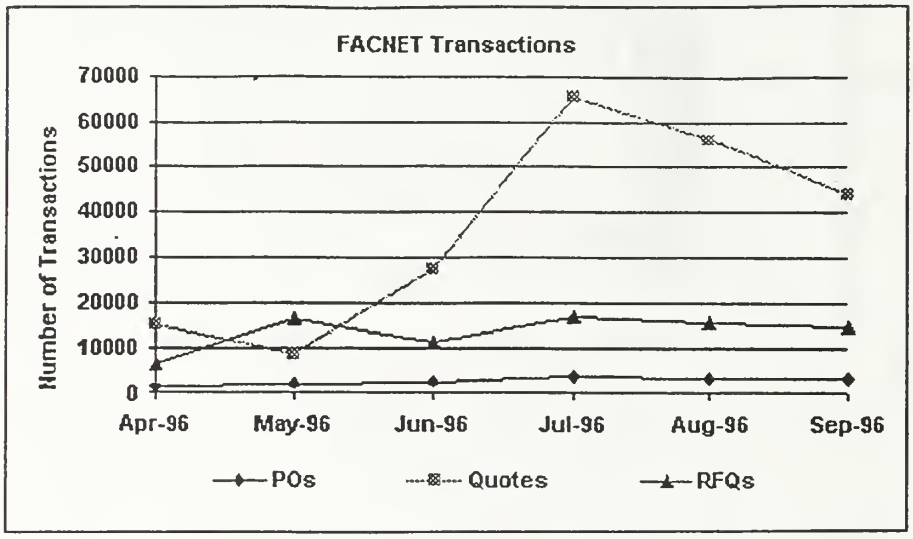

Figure 12. From Ref.[27]

(6) Multi-Year Procurement. Presents the total number and dollar value of initial multi-year procurements (Figure 13). It is an indicator of the extent of the government's long term supplier relationships.[Ref. 28]

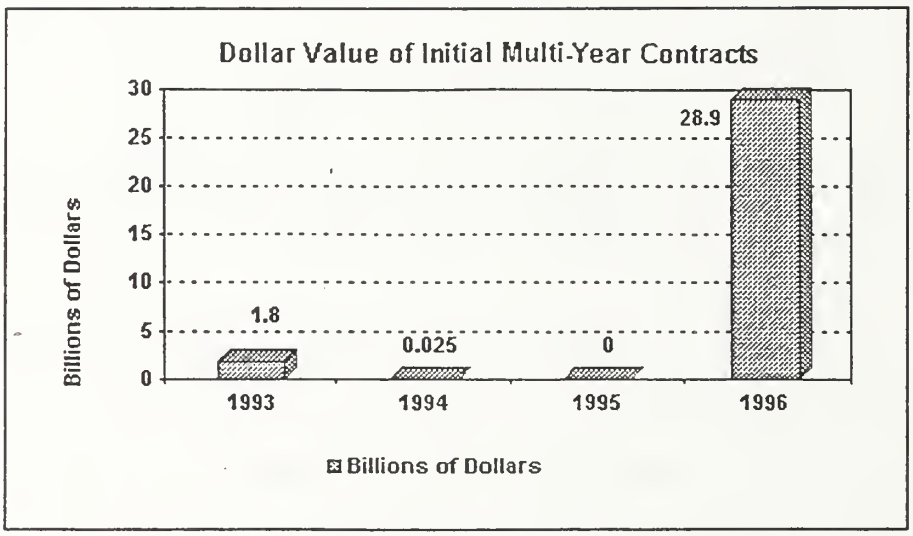

Figure 13. From Ref.[28]

(7) Administrative Lead Time (ALT). A metric that presents the average time elapsed from the initial identification of a need to the contract award (Figure 14). Improved efficiencies associated with acquisition streamlining and simplified acquisition procedures are expected to reduce ALT. At this time, the metric presents the average lead times for consumables and reparables (secondary items) across DoD. [Ref. 29]

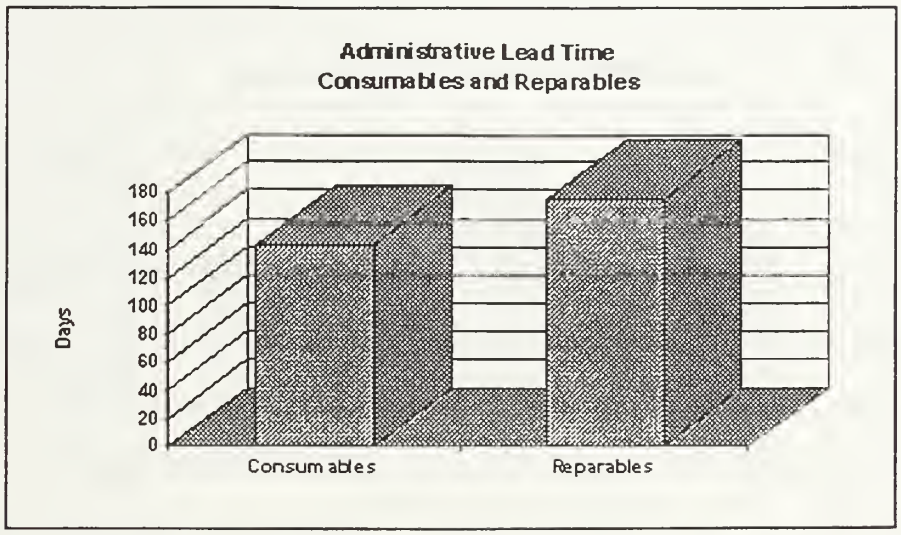

Figure 14. From Ref.[29]

(8) Contract Changes. This metric presents the number of Class 1 Engineering Change Proposals (ECPs) and major waivers/deviations for all DCMC administered contracts (Figure 15). This metric is an indicator of improved design/development processes based on streamlined business practices, reduced regulatory burdens, MIL-STD reform and IPPD. [Ref. 30]

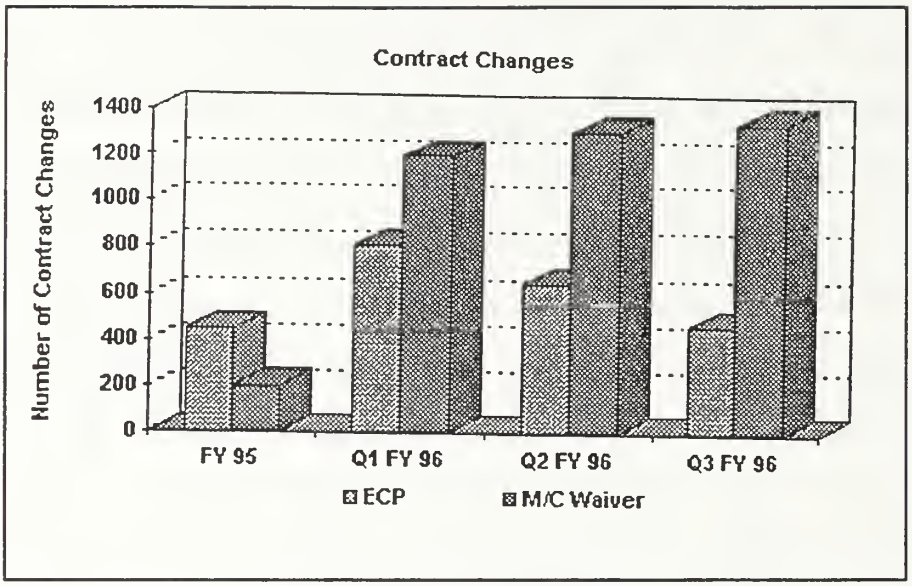

Figure 15. From Ref.[30]

(9) Contract Protests. This metric presents the number of DoD contractor protests of awards and the number of protests that were ruled in favor of the contractor (Figure 16). This metric is expected to decline with the implementation of solicitation and procurement process reform.[Ref. 31]

(10) Commercial Item Contract. An indicator of the extent of commercial item acquisition within DoD procurement (Figure 17). This metric is the ratio of contract awards for commercial items to total contract awards (number and dollar value).[Ref. 32]

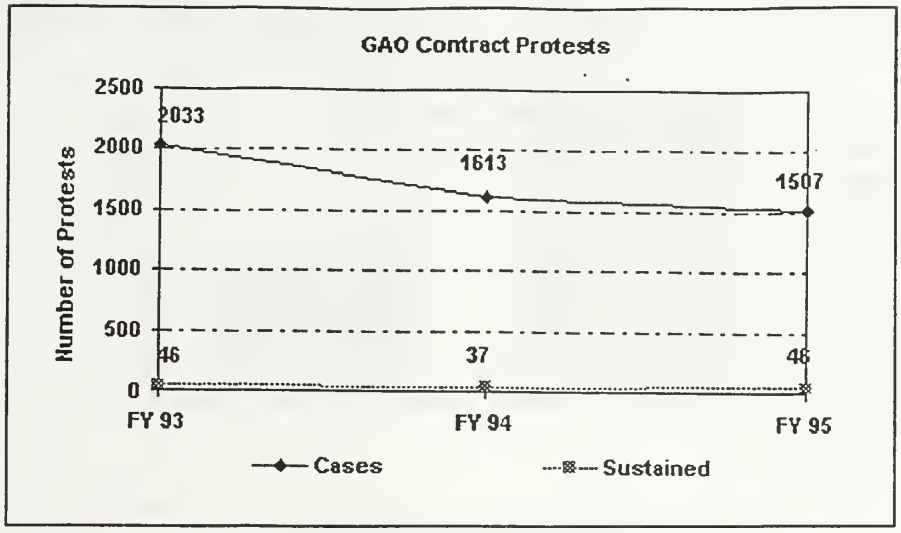

Figure 16. From Ref.[31]

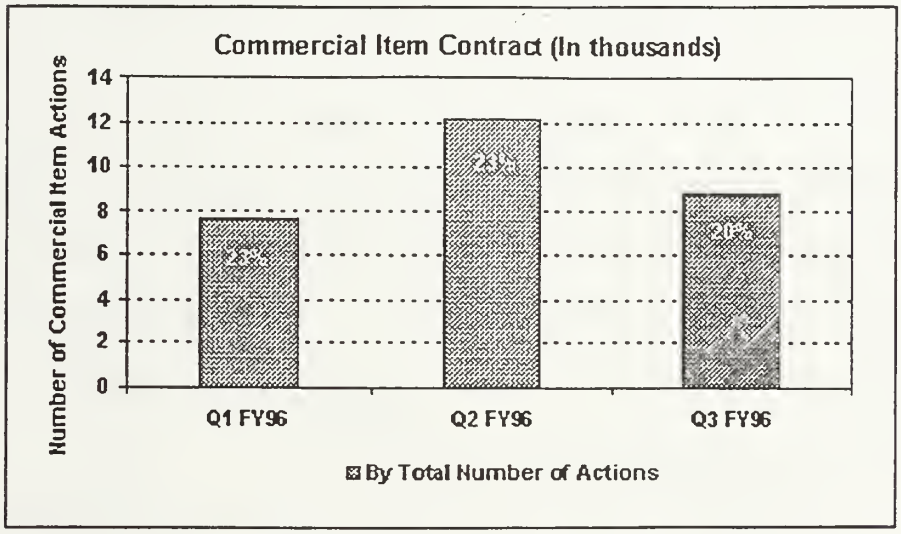

Figure 17. From Ref.[33]

(11) Cost and Pricing Data. An indicator of reduction in unique government requests for pricing data and its associated proposal preparation cost, government and contractor oversight, and restriction of the commercial contracting base (Figure 18). This metric presents the percent of actions requesting Cost and Pricing data for

actions over $500,000 and for actions under $500,000.[Ref. 33]

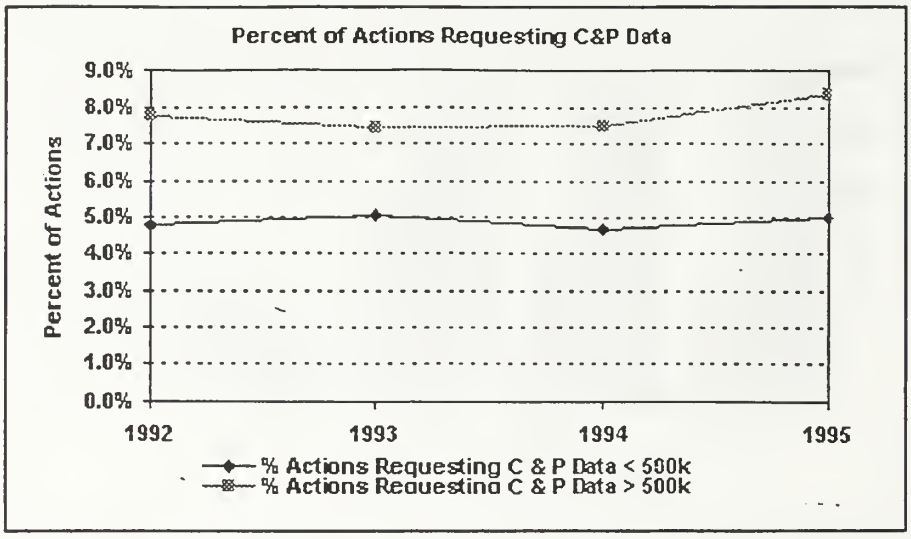

Figure 18. From Ref.[33]

(12) Acquisition Phase Time. This metric measures DoD progress in streamlining acquisition decision processes and procedures to reduce the amount of time between milestones from the concept definition through production and deployment of a weapon and/or information system (Figure 19).[Ref. 34]

(13) Logistic Response Time. An indicator of DoD's effort to move toward world class logistics practices, including simplified acquisition procedures for logistics items such as spares and consumables (Figure 20). This metric presents the average elapsed time between customer order and customer receipt of Defense Logistics Agency (DLA) items.[Ref. 35]

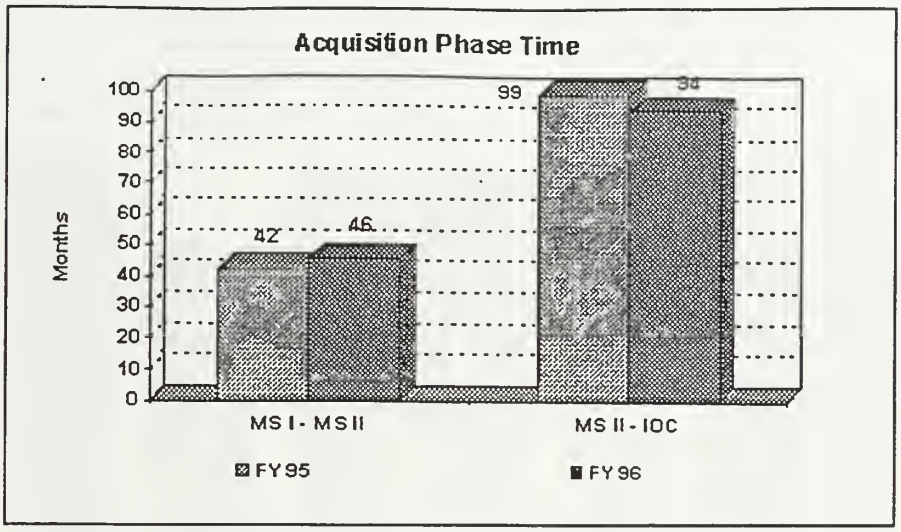

Figure 19. From Ref.[34]

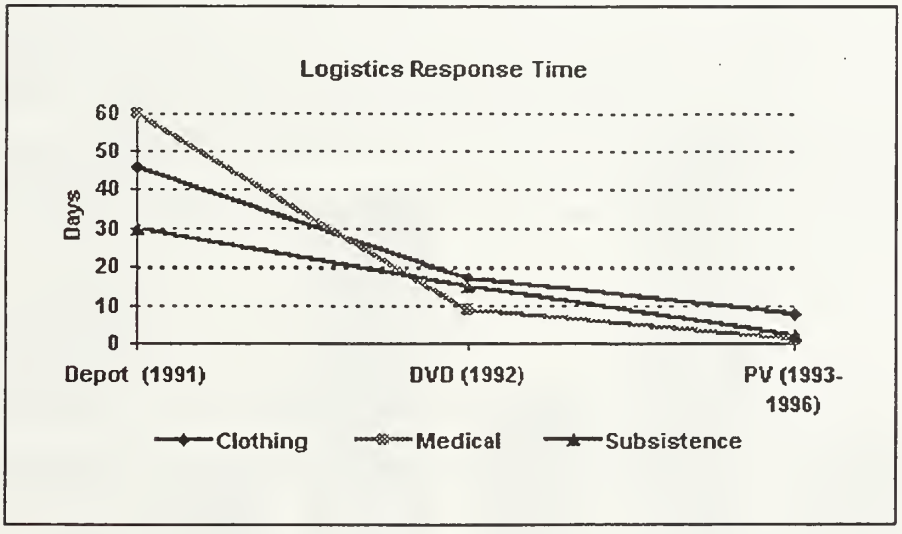

Figure 20. From Ref.[35]

c. Program Metrics

(1) Military Specifications (MILSPECs). Presents percentage reduction of the number of MILSPECs and standards in an RFP as compared to a traditional program

(Figure 21).[Ref. 36: p. 1]

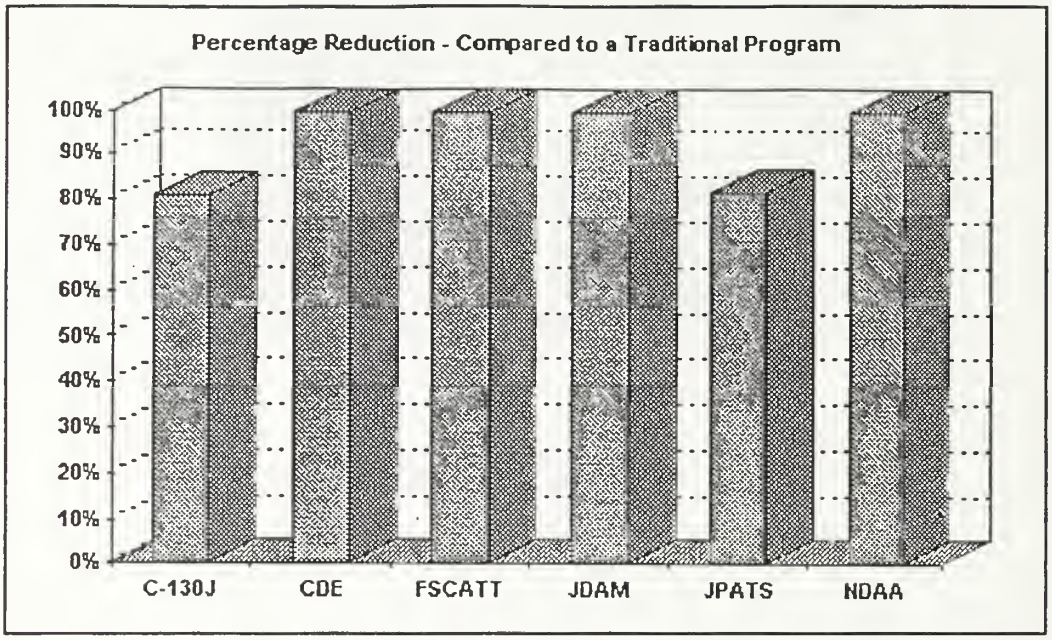

Figure 21. From Ref.[36]

(2) Contract Data Requirements List (CDRL). Presents percentage reduction of the number of CDRLs in an RFP as compared to a traditional program (Figure 22).[Ref. 36: p. 2]

(3) Contract Administration Work Hours. A metric presenting the percentage reduction of Contract Administration Services (CAS) work hours for programs using acquisition reform as compared to traditional programs prior to reform (Figure 23).[Ref. 36: p. 3]

(4) Proposal Preparation. Percentage reduction in Request For Proposal (RFP) preparation work hours as compared to a traditional program (Figure 24).[Ref.36:p. 4]

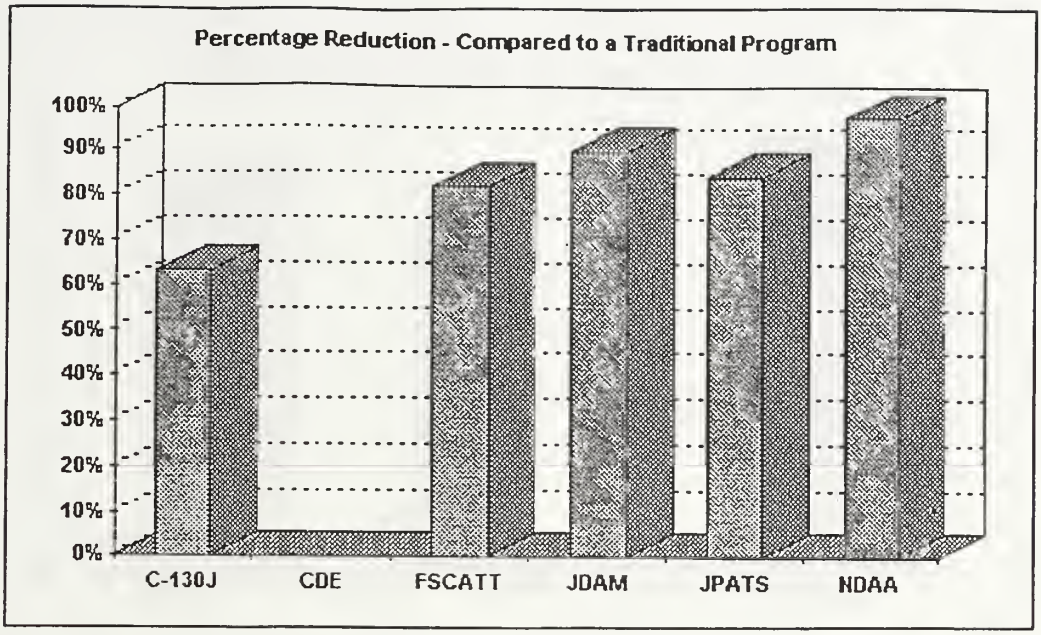

Figure 22. From Ref.[36]

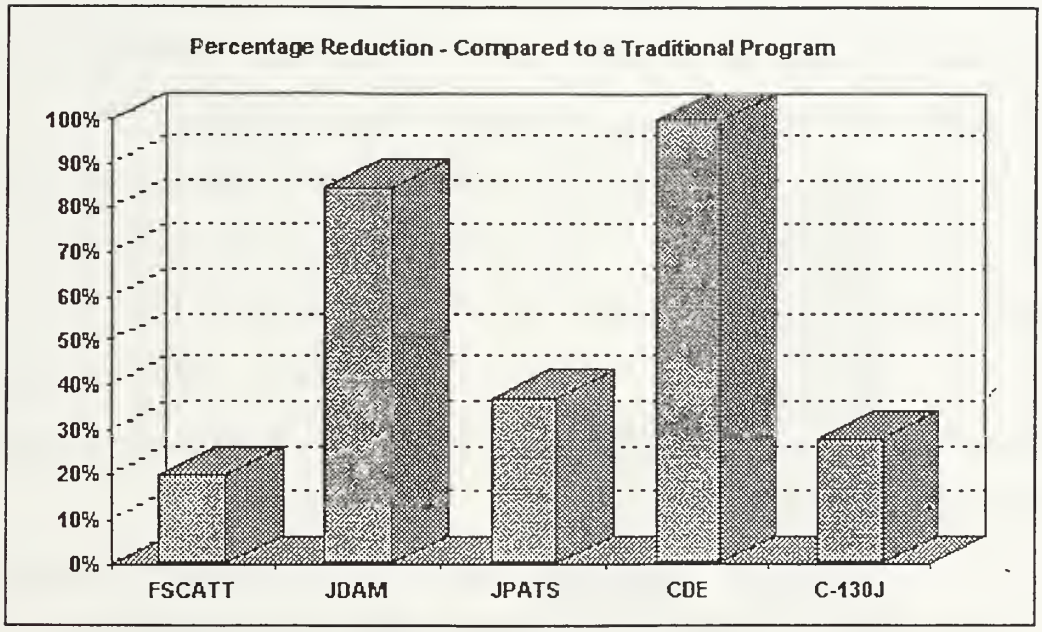

Figure 23. From Ref.[36]

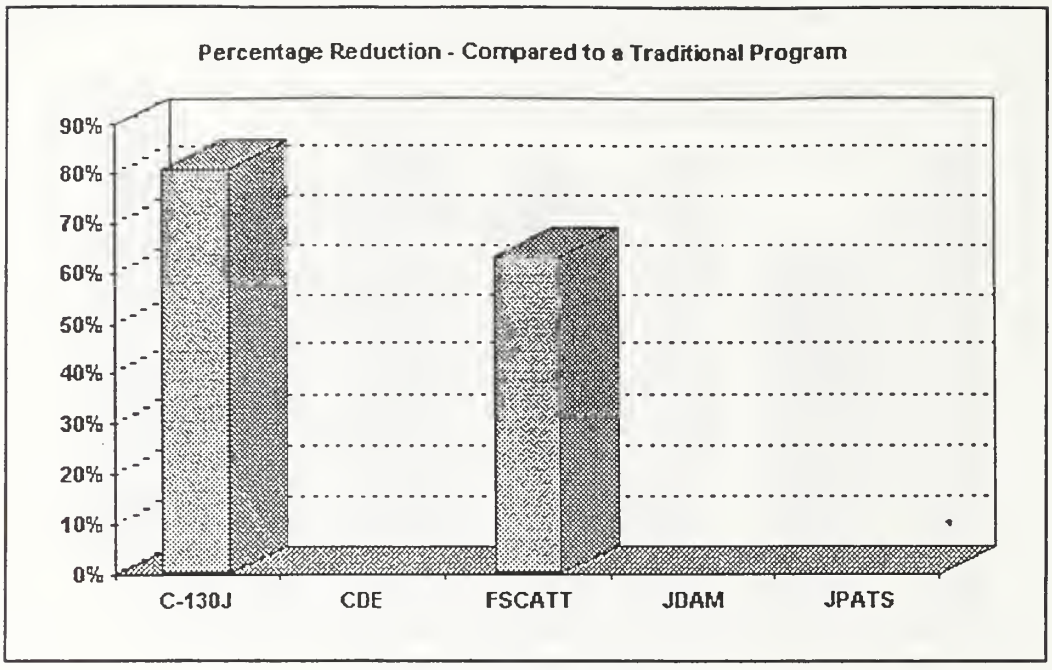

Figure 24. From Ref.[36]

(5) DCAA Audit Hours. Percentage reduction in DCAA audit hours as compared to a traditional program (Figure 25).[Ref. 36: p. 5]

(6) Proposal Evaluation Time. Percentage reduction in proposal evaluation hours as compared to a traditional program (Figure 26).[Ref. 36: p. 6]

(7) RFP Pages. Percentage reduction in the number of RFP pages as compared to a traditional program (Figure 27).[Ref. 36: p. 7]

(8) Contract Costs. Percentage reduction in contract costs (estimate vs. award) as compared to a traditional program (Figure 28).[Ref. 36: p. 8]

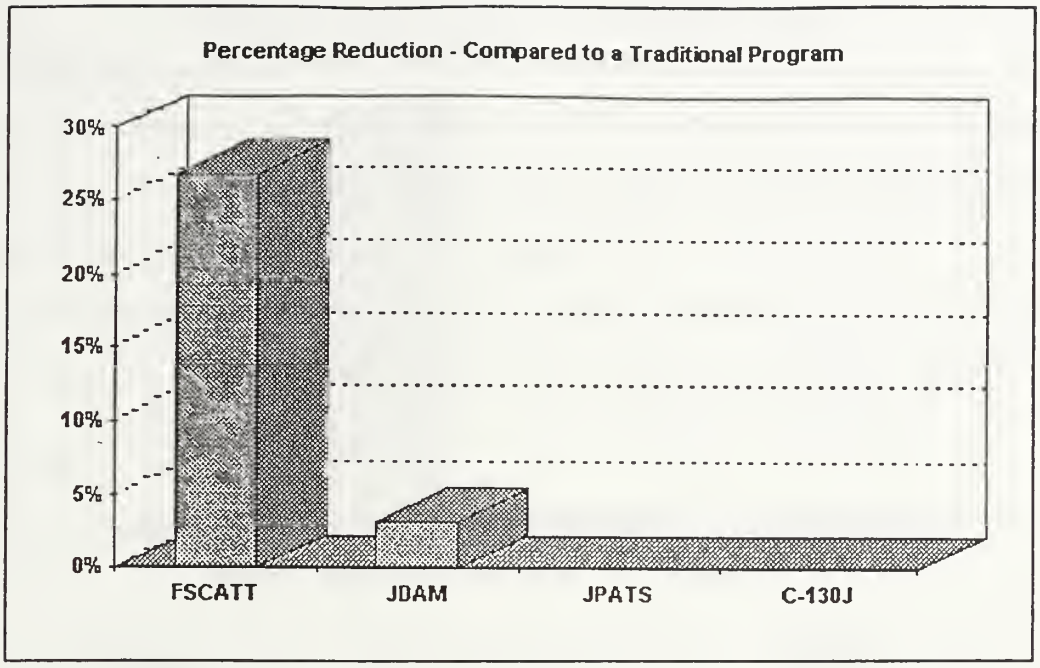

Figure 25. From Ref.[36]

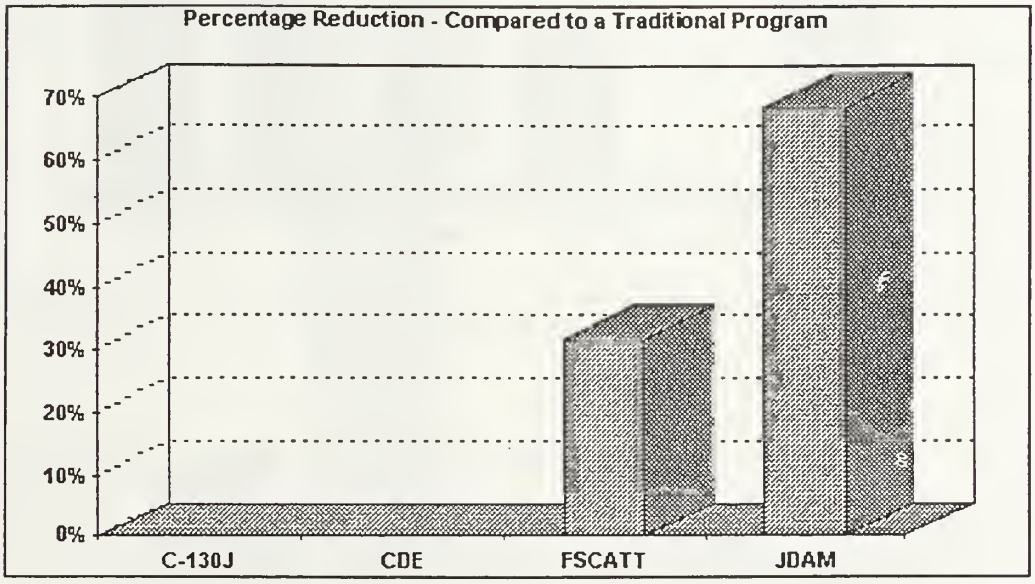

Figure 26. From Ref.[36]

(9) Program Office Staffing. Percentage reduction in program office staffing as compared to a traditional program (Figure 29).[Ref. 36: p. 9]

(10) Contract Cost Variance. Percentage reduction in contract cost variance as compared to a traditional program (Figure 30).[Ref. 36: p. 10]

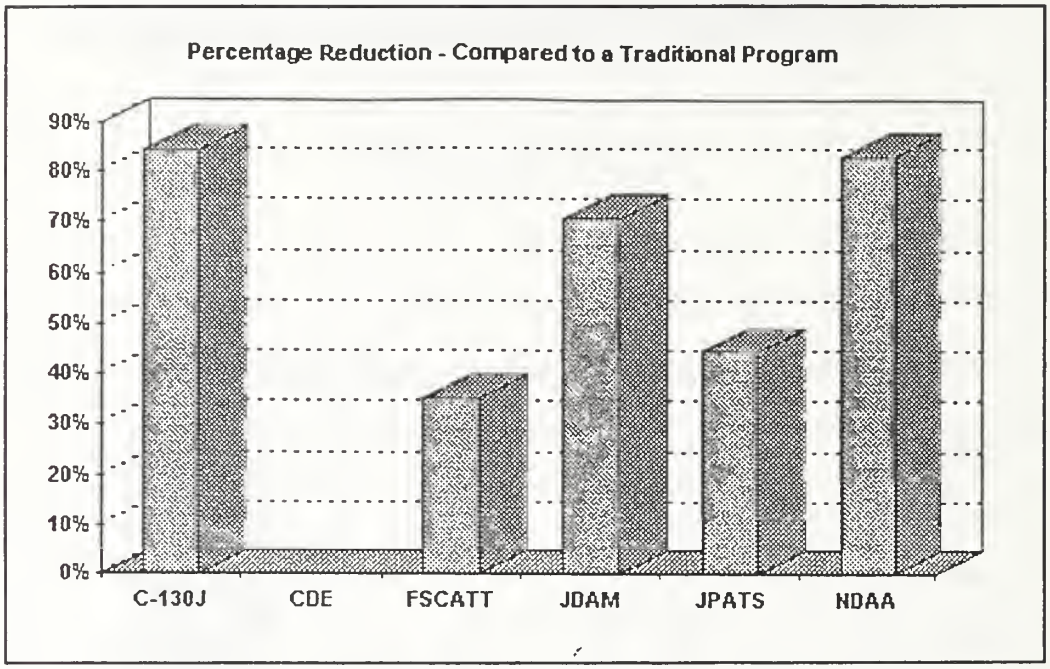

Figure 27. From Ref.[36]

(11) Contract Schedule Variance. Percentage reduction in the contract schedule variance as compared to a traditional program (Figure 31).[Ref. 36: p. 11]

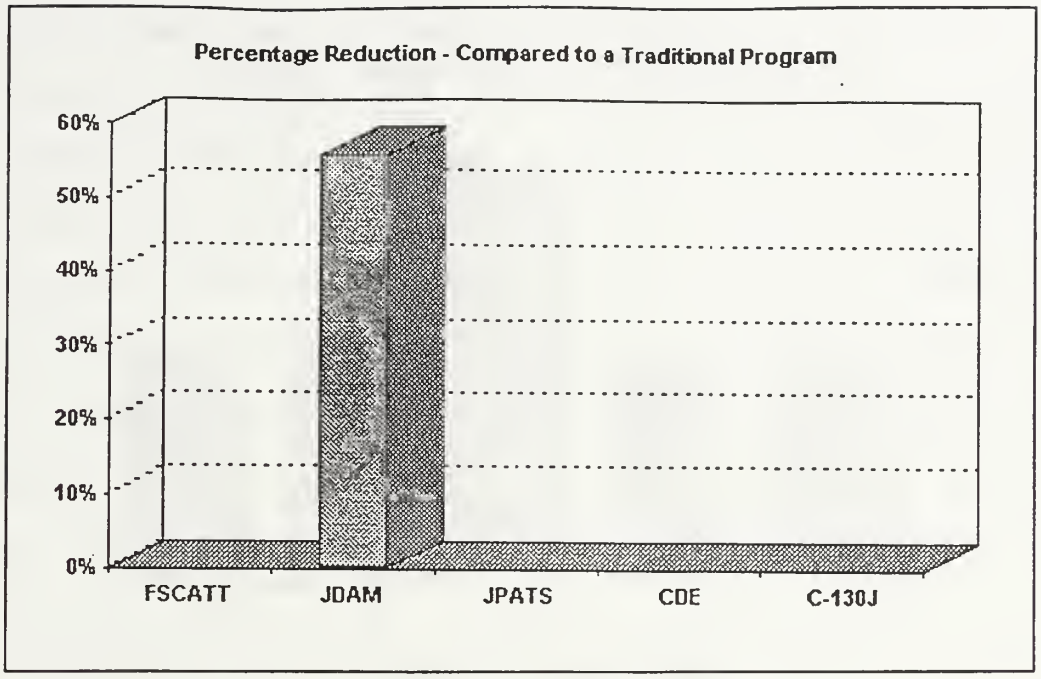

Figure 28. From Ref.[36]

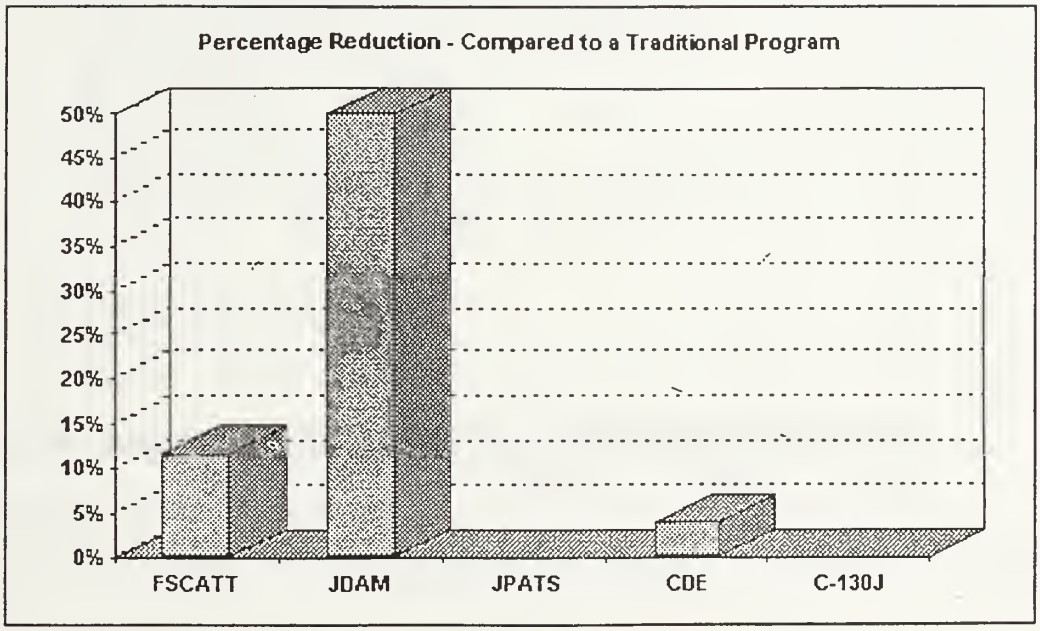

Figure 29. From Ref.[36]

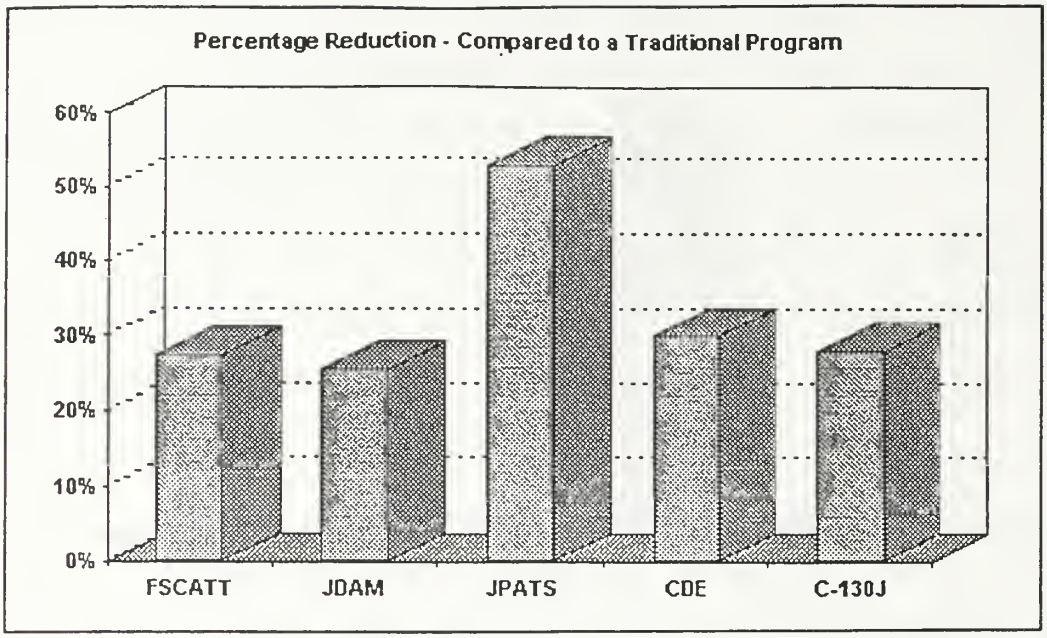

Figure 30. From Ref.[36]

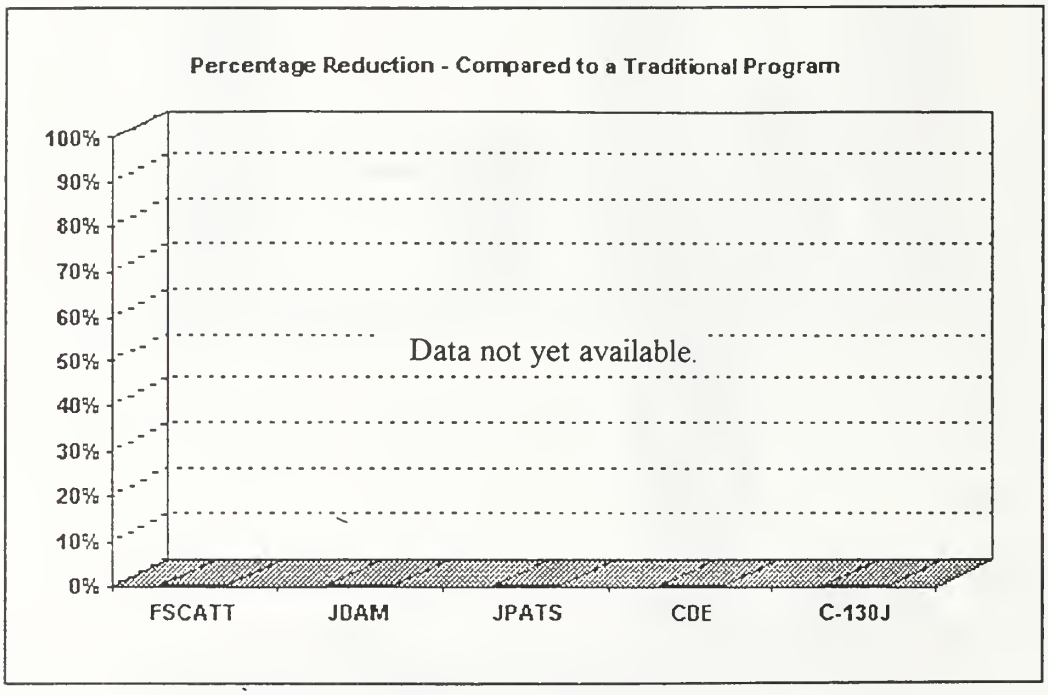

Figure 31. From Ref.[36]

2. Navy Acquisition Reform Metrics

The Department of the Navy is working to develop metrics to gauge the implementation of Acquisition Reform Initiatives. Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN(RDA)) memorandum, "Navy Acquisition Metrics - Progress Reviews," requires monthly status reviews commencing 27/28 June 1996 ". . . as a means to gauge and report progress in achieving acquisition reform strategic goals."[Ref. 37] The suggested metrics are the following [Ref. 38]:

- Average Cycle Time for Issuance of RFPs
- Use of IPTs
- RFP (ACAT 1-3) Specifications/Standards Waivers
- Use of FAR Part 12 for Commercial Item Acquisitions
- Number of RFPs Allowing Oral Presentations
- Number of Electronic Solicitations
- RFPs Using CAIV
- RFPs Considering Total Ownership Cost
- ACAT 1-4 RFPs Using Strategies to Minimize People/Training Time Needed to Operate Systems
- Electronic Data Deliverables
- EDI Usage
- Configuration Management Delegated to Contractor
- Use of Award Fees
- IPTs with Multiple-site Participation

F. CHAPTER SUMMARY

Metrics can be a valuable tool for gauging implementation, effectiveness, and success within an organization. There are many types of metrics, therefore, in order to be effective and relevant, metrics must be tailored to the needs of the organization.

Acquisition reform metrics are in the early stages of development. Most of the ARBG metrics focus on the acquisition process, gauging the improvement in cost, schedule, and performance. The Navy metrics are geared toward measuring the implementation of various initiatives. In the next chapter, we take a closer look at DAWIA and, by using the information in this chapter, develop metrics for DAWIA.

IV. ANALYSIS FOR DAWIA METRICS

A. CHAPTER INTRODUCTION

This chapter presents an analysis of DAWIA metrics using the Policy Effectiveness Model (Figure 32). This model is a tool used to analyze and develop metrics for programs, and through its application one can identify the objectives of DAWIA, identify the activities for accomplishing the objectives, and propose metrics for measuring the activities.

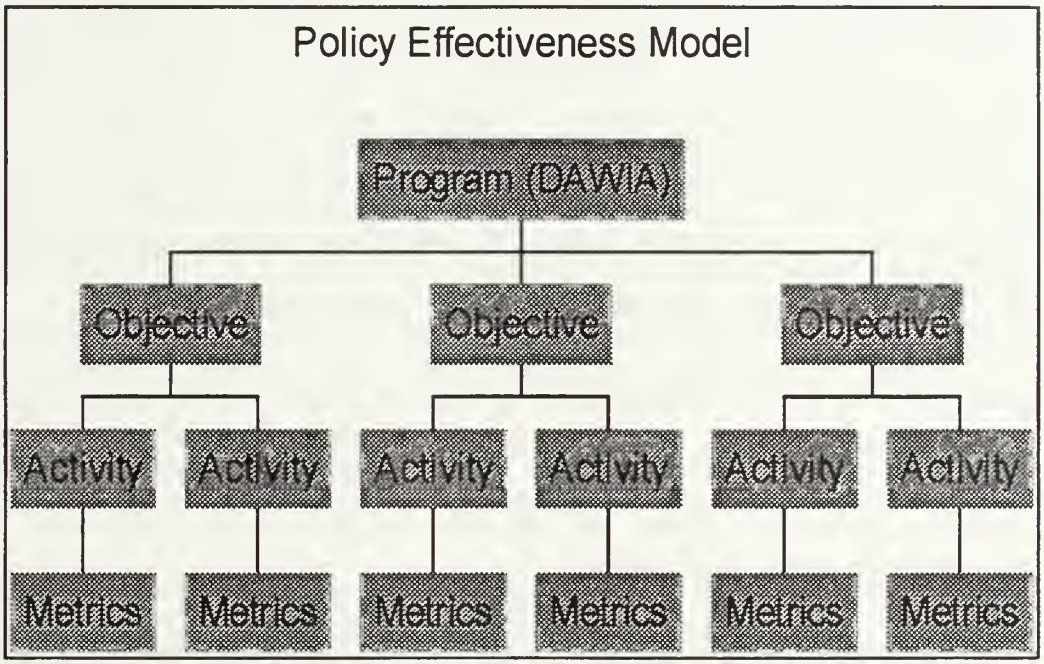

Figure 32. From Ref.[1]

B. DAWIA OBJECTIVES

The Packard Commission Report, the Congressional hearings on the acquisition workforce, and the requirements of DAWIA points to the following objectives for this detailed, far

reaching legislation:

- Provide a clear career track for the acquisition workforce
- Educate the workforce
- Increase the number of civilian acquisition positions
- Provide career growth
- Grow PMs
- Stabilize programs through reduction in PM turnover

The aim of the above objectives is to achieve the following ultimate objectives:

- Increase acquisition expertise and experience
- Control program costs
- Efficiently acquire parts, supplies, materials, and programs

The first seven objectives focus on improving the quality of the workforce. The last two objectives focus on improving the acquisition process. DAWIA aims to produce a quality workforce that results in an improved acquisition process. Now we must determine ways to measure these objectives.

C. ACTIVITIES AND METRICS FOR DAWIA OBJECTIVES

The following subsections are DAWIA objectives, as identified above. Within each subsection are the activities for accomplishing the objective and proposed metrics for measuring each activity.

1. Provide a Clear Career Track for the Acquisition Workforce

a) Activity: Identify acquisition workforce positions and define a career path that provides development opportunities and progression.

Metrics: To measure this activity, use a go/no-go metric that determines whether acquisition positions have been

designated. Use another go/no-go metric to determine whether the positions are organized and show career progression. We can measure by surveying acquisition workforce opinions on their satisfaction with the career track established for their career field.

b) Activity: Identify qualification requirements for acquisition workforce positions.

Metrics: Measure by determining the percentage of workforce positions that have specified qualification requirements. Also measure by determining the percentage of workforce members occupying acquisition positions that meet the position's qualification requirements.

c) Activity: Establish developmental opportunities (i.e. developmental jobs, training, and education).

Metrics: Use a go/no-go metric to determine whether developmental opportunities have been identified. Another metric presents the ratio of the number of acquisition workforce members to the number of acquisition developmental slots. An additional metric could be used to measure the progression of workforce members following developmental assignments. For example, we could measure the average pay increase or grade increase for workforce members who completed developmental assignments and compare figures to those who haven't completed developmental assignments.

d) Activity: Centrally manage acquisition positions and training opportunities.

Metrics: Use a go/no-go metric to determine whether an organization has been established to centrally manage acquisition positions. A metric could measure the percentage of positions that have been filled through centralized selection. Use a go/no-go metric to determine whether an adequate centralized information system has been established to enhance the military departments' ability to centrally manage the acquisition workforce.

e) Activity: Effectively communicate the career track information to the workforce.

Metrics: Measure by surveying a sample of the workforce regarding knowledge of their career path, qualification requirements, and developmental opportunities. A resulting metric could present the percentage of acquisition workforce members that possess adequate knowledge of their career path.

2. Educate the Workforce

a) Activity: Establish training and education opportunities.

Metrics: Measure the number of acquisition related training and education opportunities available to the acquisition workforce. Compare this number to pre-DAWIA levels if the data is available. Another metric presents the amount (measured in hours, classes, degrees, etc.) of education and training acquisition workforce members have received before DAWIA and after DAWIA. A metric proposed by the ARBG in the previous chapter (Fig. 5) measures workforce

quality by presenting the percentage of acquisition certified personnel.

b) Activity: Conduct an intern program to provide individuals opportunities for accelerated promotions, career broadening assignments, and specified training to prepare them for entry into the Acquisition Corps.[Ref. 7: p. 1651]

Metrics: Measure the percentage of workforce members that enter and complete intern programs. Compare these figures to pre-DAWIA figures (if available). Measure career progression of individuals following completion of intern programs by measuring the average pay increase, grade increase, or job advancement and compare to pre-DAWIA figures (if available).

c) Activity: Conduct a cooperative education credit program in which accredited institutions of higher education grant undergraduate credit to workforce members for work performed in acquisition positions.[Ref. 7: p. 1652]

Metrics: Measure the number of educational institutions participating in the cooperative program and compare to pre-DAWIA. Measure the percentage of workforce members participating in cooperative programs and compare to pre-DAWIA.

d) Activity: Establish a scholarship program for the purpose of qualifying personnel for acquisition positions.[Ref. 7: p. 1651]

Metrics: Use a go/no-go metric to determine whether a scholarship program has been established. Measure the

percentage of acquisition personnel participating in the program. Measure the career progression of personnel that complete the program.

e) Activity: Provide tuition reimbursement and student loan repayment for acquisition personnel.[Ref. 7: p. 1653]

Metrics: Measure the percentage of acquisition personnel that receive these forms of payment. Compare to the pre-DAWIA percentage (if available).

3. Increase the Number of Senior Level Civilian Acquisition Positions

a) Activity: Increase the number of senior level civilian acquisition positions.

Metrics: Measure the percentage of senior level positions civilians are eligible to occupy. Compare this percentage to the pre-DAWIA percentage. Also measure the actual civilian occupancy of those positions and compare to pre-DAWIA.

b) Activity: Provide civilian leadership and management training.

Metrics: Measure the quantity of civilian leadership and management training offered. Measure the percentage of the civilian acquisition workforce that have attended the training. Compare these figures to pre-DAWIA figures (if available).

4. Provide Career Growth

a) Activity: Provide a career growth model.

Metric: Measure career growth of acquisition workforce

members by tracking promotion rates, pay increases, job advancement, etc. Compare these numbers to pre-DAWIA figures (if available).

5. Grow Program Managers (PMs)

a) Activity: Establish career paths and training/education opportunities that lead to PM selection for acquisition workforce members.

Metrics: Measure the percentage of PMs that began at the most junior level within the acquisition workforce and compare to pre-DAWIA percentage. Measure the average amount of PM acquisition experience, education and training and compare to the pre-DAWIA average. Measure the promotion rates of military acquisition members and compare to the promotion rates of non-acquisition military. Compare results to those results prior to DAWIA.

b) Activity: Provide opportunities for job variability.

Metrics: To grow PMs, ideally a system would be established to expose workforce members to various areas of acquisition(i.e. program management, testing, requirements development, logistics, etc.). Therefore, we can measure this activity by tracking variability in job areas and perform ongoing trend analyses.

6. Stabilize Programs Through Reduction in PM Turnover

a) Activity: Require PMs to remain in position until completion of the major milestone that occurs closest to the PM's four year mark.

Metrics: Measure average time an occupant serves as a PM. Compare to the pre-DAWIA time. Measure the average number of PMs for all programs from program conception to fielding of the system and compare to pre-DAWIA average.

7. Increase Acquisition Expertise and Experience

a) Activity: All of the previous activities support this particular objective. We must determine if the above activities result in increased expertise and experience.

Metrics: Measure expertise through the use of a standardized test. Link expertise to workforce membership in professional associations that have qualification requirements such as exam requirements, experience, etc. Measure the number of members. However, if professional association membership is voluntary, this metric can be misleading and offer little indication of workforce expertise. An alternative could be establishing a DoD professional association that requires personnel occupying certain critical acquisition positions (i.e. Program Managers) to certify through use of an exam or other criteria.

If we assume a positive relationship exists between expertise and promotion, measure the promotion rates of the workforce and compare to pre-DAWIA. To measure experience, measure the average number of years of acquisition experience of each workforce member and compare to pre-DAWIA.

8. Control Program Costs

a) Activity: Create a quality workforce through

training, education, and experience that results in improvement in program cost control.

Metric: The objective of any relevant metric would be to link quality of personnel to program cost control. As a result, measure the training, education, and experience levels of personnel who served on programs that controlled costs. Compare these figures to programs that did not control costs. In the comparison look for any trends that relate quality of personnel (i.e. meets certification requirements) to program cost control.

9. Efficiently Acquire Parts, Supplies, Materials, and Programs

This particular objective is the ultimate objective of acquisition reform and DAWIA. All of the above DAWIA objectives and activities are a subset of this objective. What's needed in order to develop activities and metrics for this objective is to establish a link between DAWIA (objectives and activities) and improved efficiencies in acquiring parts, supplies, materials, and programs.

a) Activity: Establish a quality workforce by mandating training, education, and experience requirements that result in improved efficiencies when acquiring parts, supplies, materials, and programs.

Metrics: To measure, we begin with the acquisition reform metrics identified in the previous chapter (Figures 1-31) to determine whether the acquisition process has shown efficiency

improvement.

The next step to establishing metrics for this activity is to determine what impact a higher quality workforce would have on an improved efficiency. This can be a challenge since an improved efficiency could result from many factors other than or in addition to training and education, as mentioned in the previous chapter.

However, many of these factors may indirectly involve training and education. A number of the enterprise metrics, as defined by the ARBG, attempt to measure improvements resulting from various initiatives i.e. performance specifications, IPTs, commercial specifications, etc.

In order for the initiatives to be effective, they must be properly implemented. Proper implementation often requires a sufficient amount of training and education. Therefore, a useful metric could measure the quantity or percentage of the acquisition workforce that has been trained on a particular initiative. Additionally, this type of metric could be an indicator of an initiative's implementation and effectiveness. This type of metric links training and education to other reform initiatives.

For example, proponents for the use of IPTs expect to see improved efficiencies (i.e. reduced acquisition cycle time) resulting from their use. Obviously, there are many factors that could determine the success of an IPT. However, one cannot ignore the importance of training workforce members in

the proper use of IPTs. Thus, we would measure the percentage of the workforce that has received adequate (adequate would have to be defined) IPT training. If the training numbers are low and we see little improvement in efficiencies that result from IPT use, then there could be a correlation.

If the training numbers are high and there is little efficiency improvement, reasons could be inadequate training, inadequate implementation, or ineffective concept. Regardless of reason, use of this metric could help determine why an initiative is failing to reach expectations and thus help leaders direct future efforts.

There could be other effects of a better quality workforce on the acquisition process that are worth considering. These effects are usually stated in terms of organizational benefits and, in some cases, can be translated into improvements in cost, schedule, and performance.

Some of the benefits identified below can be used directly as metrics since they are quantifiable. Other benefits are not quantifiable and in order to be used as metrics they must be converted into measurable form. This measurable form can be a rating, of say, 1, most negative, to 10, most positive (the difficulty with using rating metrics is that you can't go back in time to collect data on these type of metrics if similar ratings were not used). Thus the list of benefits that follow (Table 1)can be used as direct metrics and rating metrics [Ref. 12: p. 5]:

Decreases or reductions in	Increases or improvements in
Absentee rate	Attitude rating towards the enterprise
Break-in time for new hires	Communication skill rating
Customer complaints	Leadership rating
Employee errors	Customer relation rating
Employee tension rating	Customer satisfaction rating
Grievances	Employee attitude rating
Labor disputes	Employee job satisfaction rating
Lost time	Employee judgement rating
Misfits	Employee morale rating
Misinterpretations of policy	Employee motivation rating
Operating costs	Employee suggestions
Rejects and reworks	Employee work habit rating
Requirements for overtime	Enterprise flexibility and adaptability to changing conditions rating
Sick-leave rates	Human relations skills rating
Tardiness rates	Labor relations rating
Time required to introduce new products or processes	Quality of management and supervision rating
Turnover rate	Rating for the understanding of organization goals, plans, policies, procedures
Unit costs	
Violations of rules and regulations	
Work backlog rate	

Table 1. After Ref. [12]

D. CHAPTER SUMMARY

The objectives of DAWIA focus on two major areas--improve the quality of the workforce and improve the acquisition process. This study used a methodology for developing metrics for these objectives. This chapter introduced metrics for measuring the quality of the workforce and metrics for linking the quality of the workforce to an improved acquisition process. These metrics can help to determine how well DAWIA has been implemented and how effective DAWIA has been towards improving the quality of the workforce and the acquisition process. However, there is still a continuing need for research to analyze and refine metrics for DAWIA.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Various reform initiatives have attempted to improve the acquisition process. The success or failure of these initiatives have often been based on subjective determinations. In order to determine the true effect of these initiatives, we must be able to use metrics to measure the implementation and effect of the initiative on the acquisition process.

DoD, through the establishment of the Acquisition Reform Baseline Group (ARBG), has initiated efforts to develop metrics for measuring the effect of acquisition reform initiatives. However, only one of the ARBG proposed metrics relates to DAWIA. This metric, the acquisition workforce metric, measures the certification percentages of the acquisition workforce. This metric is primarily linked to DAWIA's objective of educating the workforce.

This study identified the specific objectives of DAWIA. This study used the Policy Effectiveness Model to analyze DAWIA's objectives and introduce metrics that can possibly be used to measure these objectives. Use of these metrics could ultimately result in an ability to measure the effectiveness of DAWIA.

B. RECOMMENDATIONS

Based on the history of acquisition reform, the benefits of metrics, and the tools available for developing metrics, this study recommends that metrics continue to be developed and refined to measure the implementation and effectiveness of acquisition reform initiatives. Metrics development should occur prior to implementation of initiative using the following steps:

1. Determine the initiative's objectives.
2. Determine the activities for accomplishing the objectives.
3. Develop metrics for measuring the activities.
4. Implement the initiative.
5. Measure the activities using the metrics.
6. Analyze the measurements and make an assessment on the initiative's implementation and effectiveness.
7. Make changes based on the assessment.

This study also recommends that the proposed ARBG metrics be expanded to include DAWIA metrics. Also redefine some of the ARBG metrics so that they consider the impact of a higher quality workforce. Improved efficiencies result not only from initiatives but also from an improved workforce.

Finally, this study recommends that DAWIA metrics be linked to acquisition reform by establishing metrics to monitor workforce training on reform initiatives. Effective

implementation of initiatives requires adequate training. In order to properly assess implementation of a reform initiative it is necessary to measure workforce training on the initiative.

C. ANSWERS TO RESEARCH QUESTIONS

1. How can DAWIA's effectiveness be measured?

Begin by determining the objectives of DAWIA. Next, determine the activities that will have to be accomplished in order to meet those objectives. Finally, develop metrics for measuring those activities.

2. What are the specific objectives of DAWIA?

The specific objectives of DAWIA are as follows:

- Provide a clear career track for the acquisition workforce
- Educate the workforce
- Increase the number of civilian acquisition positions
- Provide career growth
- Grow PMs
- Stabilize programs through reduction in PM turnover

The aim of the above objectives is to achieve the following ultimate objectives:

- Increase acquisition expertise and experience
- Control program costs
- Efficiently acquire parts, supplies, materials, and programs

3. What is a metric and what types of metrics are suitable for acquisition reform?

Metrics are quantifiable measures that allow us measure people, processes, and products. Suitable metrics for acquisition reform enable us to measure the implementation and

effectiveness of acquisition reform initiatives thus allowing us to assess the initiative's impact on the acquisition process.

4. What metrics are currently being used to measure the effects of DAWIA on the acquisition process?

Metrics are not being used or proposed to directly measure DAWIA's effect on the acquisition process. The only DAWIA metrics currently proposed measures the effectiveness of the qualification requirements on the workforce by measuring workforce certification percentages.

5. Are these appropriate metrics?

This metric is appropriate, but is very limited in its usefulness. If the only objective of DAWIA was simply to increase the education levels of the acquisition workforce, then this metric would completely serve the purpose. However, DAWIA has other objectives that not only aim to improve the quality of the workforce but the quality of the acquisition process. Thus, there is a need to expand DAWIA metrics in order to measure and assess DAWIA's impact on the acquisition process.

6. Are there standardized metrics for acquisition reform initiatives? If not, should standards be established?

The DoD Acquisition Reform Baseline Group has proposed a set of metrics that appear to be headed towards a standard for measuring the effects of acquisition reform. These metrics should be standardized with consideration for adding the

DAWIA metrics proposed in Chapter IV of this study.

D. RECOMMENDATIONS FOR FURTHER STUDY

This study is the initial step towards developing measures of effectiveness for DAWIA and other acquisition reform initiatives. There is more work to be done. Following are recommendations for study that will further advance efforts towards measuring the effectiveness of acquisition reform:

1. Further refine DAWIA metric design.

2. Conduct tests of significance for DAWIA metrics on the acquisition process.

3. Measure and assess the effectiveness of DAWIA by applying the metrics developed in this study.

4. Perform similar studies in other areas of acquisition reform by applying the methodology used in this study. This should lead to the development of metrics for measuring the implementation and effectiveness of other Government reform initiatives.

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